FLIGHT and The AIRCRAFT ENGINEER

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The Outlook

Contra-props

THE knowledge, now officially released, that engines have come into service which develop somewhere around 2,000 b.h.p. revives the associated problems of how best to convert that tremendous power into thrust. That three-bladed and four-bladed variable-pitch airscrews are in existence which absorb this high power with good efficiency is known, but it does appear likely that it will become necessary to look even farther than that.

In this connection one is reminded that many years ago the Italians employed two co-axial airscrews running in opposite directions. The outfit was used on the Macchi-Castoldi seaplanes of the Italian High-speed Flight and a world's speed record was established. The great advantage, in this particular application, was that there was not the "swing" associated with orthodox airscrew arrangements, as the opposite rotations took the twist out of the slipstream and did away with that enormous torque-reaction which caused our Schneider Trophy seaplanes to start their take-off runs at right angles to the wind.

On single-engined landplanes the problem is not quite so serious. For one thing, the torque-reaction does not cause one wheel to dig in, in the way it caused one float of a Schneider seaplane to dig in, but the tendency to swing is still there. Even in twin-engined aircraft such a tendency exists, and with the powers now available, the forces to be met are greatly increased. Thus there would seem to be good cause not to overlook the claims of double airscrews.

There are other aspects of the problem which come into the picture, airscrew size and diameter among them. Obviously, if one uses two airscrews to absorb the power, each is called upon to deal with only one-half the power, and a small diameter and lighter airscrew can be employed. It should not be necessary to go abroad for ideas in this direction, for it is now many years since the Fairey firm began development work, and the Fairey "contra-props" were on view at more than one R.Ae.S. garden party. Presumably the firm would, if requested to do so, design double airscrews to absorb the greater power of the modern engines. Gearing would, of course, have to be provided on the engines.

In the Balkans

THE Germans have started their operations in the Balkans in typical fashion by heavy air raids on Belgrade. It had been declared an open town, but when the enemy are Germans such a declaration has no value. The wireless from the Yugoslav capital has made the statement, "In the ruins of Belgrade a greater capital of all Southern Slavs is to be erected." This suggests that the devastation must be of a very widespread nature, and it is probable that in this first experience of German air attacks the preparations in the city for dealing with fire bombs were not highly organised. The first serious raid by fire bombs on the City of London found our own preparations far from perfect, although the *Luftwaffe* had been showing its hand over Britain for many months; so we may conclude that Belgrade suffered badly.

On the other hand, the R.A.F. has begun its Balkans campaign in heartening fashion. The raid on Belgrade was promptly answered by an attack on Sofia, the capital of Bulgaria, in which the main railway station and other military objectives were heavily bombed. R.A.F. fighters, too, soon gave the advancing Germans a taste of their quality. A small formation of Hurricanes found thirty Messerschmitt 109s over the important Rupel pass on the Struma river in Bulgaria. The Hurricanes promptly attacked and definitely shot

down five of the enemy fighters, while others were damaged. Our own losses were nil.

This little engagement bodes well for us. One of the chief German problems in the Balkans campaign will be to get their troops through the narrow passes in the mountains, of which the Rupel is one of the most pronounced. If this is to be accomplished without heavy losses through air bombing, the German fighters must be able to protect their troops and hold off the British bombers and fighters. In the opening round the Messerschmitts failed signally to keep the mastery of the air. Much may follow from this.

Civil Aviation

FLIGHT has always advocated the maximum possible expansion of civil aviation on the grounds that it is an influence leading towards the peaceful development of the human race by stimulating human intercourse and making it easier for the various racial cultures to become the common property of all. The civil aeroplane can make it easier for one nation to "talk" to another, and we believe that this is the fundamental moral justification for the continuance of aeronautical effort. But if, in its difficult upward climb towards perfection, mankind sometimes slips backward and relapses into armed conflict of the most bitter kind, the civil aeroplane can serve a national purpose and can help very greatly towards the survival of one or other of the warring factions. No one can now doubt the military value of civil aviation, for both personnel and aircraft have been called upon to the limit in the war effort, and the demand is still unsatisfied. We are lucky to be able to obtain a few civil aircraft from the United States, but how deplorable it is to have to admit that we cannot supply our own needs to run even a few overseas services. This has been noticed on the other side of the Atlantic, and a recent issue of *American Aviation* comments:

"What a different story might be told to-day if Great Britain had developed a vast fleet of commercial aeroplanes to tie together the widespread British Empire. During 1940 one British flying-boat made a half-dozen crossings of the North Atlantic. What if Britain had had a fleet of hundreds of long-range flying-boats, aeroplanes capable of carrying scores of passengers across the Atlantic? How much easier the conduct of the present war would have been had the Empire been closely knit with a real network of air services. What a training backlog for pilots and operations personnel!"

"Flight" copyright sketch.

BATTLE OF MATAPAN: An impression by "J.P." of Fairey Albacores of the Fleet Air Arm making torpedo attacks on the Italian Fleet in order to slow up their retreat and bring them to action.

War in the Air

Fighting in the Balkans : Fall of Addis Ababa : Kiel and Brest Raided : Night Fighters' Successes

SEVERAL times in the last few weeks the suggestion has been put forward in these columns that the sudden cessation of the British advance towards Tripoli and the subsequent evacuation of Benghazi were due to the necessity of sending troops across to the Greek frontier in Macedonia and Thrace. This speculation has now been justified; a British Army is in position on the northern frontier of Greece, and the Royal Air Force in that country has been strongly reinforced. That also had been foreseen in *Flight's* estimate of the situation.

General Wavell's race to complete the conquest of Italian East Africa before the outbreak of the rains and also, if possible, before the German forces began to advance in the Balkans, was nearly won. Part of it was won, for his men were into Addis Ababa before the rains began, and that meant that the remaining Italian resistance could not be very formidable. The process known as mopping up was really all that remained to be done. In this process the command of the air is a priceless advantage, for Empire aircraft can keep track of retreating Italian columns and can make their progress most unhappy. The pursuing troops need waste no time in speculating as to which direction the retreating force may have taken. They have precise information.

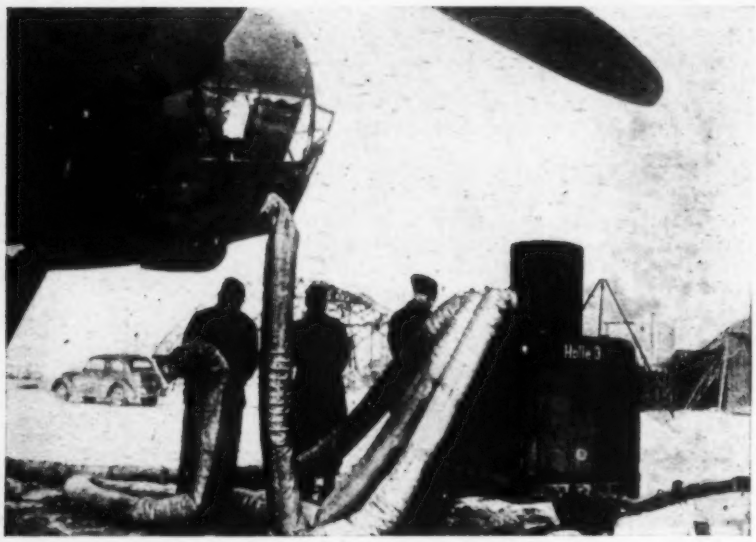
East Africa Falling

ON the same evening on which the B.B.C. announced the occupation of Addis Ababa it also announced the attack by the Germans on the Greeks and Yugoslavs. So Sir Archibald Wavell had not quite cleared up the East African business before that move began. It was probably too much to hope that he would be able to do so, but he has come very near it. It should not be long before a substantial part of his Army will be set free for transport across to Greece, and already he has probably been able to dispense with a very fair proportion of the air squadrons which have done such splendid work in helping our ground troops. In the near future it may be that the South African Air Force will be able to provide the bulk of the air work needed in Northern Africa, while the R.A.F. squadrons may cross over to the Greek front.

"BLOODED": The Grumman Martlet I, now in service with the Fleet Air Arm as a single-seater fighter, scored its first victory—a Junkers Ju 88—recently.

It was no doubt wise of the Italians not to fight for the occupation of Addis Ababa after the fall of Diredawa and the crossing of the Awash river. At Diredawa our men found numerous Italian aeroplanes in various stages of unfitness. No wonder the Italians felt that the stars in their courses, and other powers of the air, were fighting against them. It must have added to the bitterness of their humiliation to remember how it was their own Air Force which played so great a part in their rapid conquest of Ethiopia five years ago. They must also have reflected how their aircraft had showered mustard gas upon the bare-limbed Ethiopian soldiers (and civilians), insolent in their power, and believing that their opponents could never get the upper hand of them or have a chance of paying them back in their own coin. Now they welcome the arrival of British victors to save them from massacre at the hands of African deserters from their own Army. The Patriots have received orders from the Negus not to behave with brutality towards Italians who fall into their hands, for Haile Selassie stands on a higher plane of humanity than Mussolini. Deserters are not under the control of the Negus. However, H.R.H. the Duke of Aosta, the Governor-General of all Italian Africa, is a gentleman—as one would expect of a cousin of the King of Italy—and he has sent a message to Lieut. Gen. Cunningham saying that he "wishes to express his appreciation of the initiative taken by General Wavell and General Cunningham regarding the protection of women and children in Addis Ababa, demonstrating the strong bonds of humanity and race still existing between the nations." Good! But we British admit no "bonds of humanity" between us and Mussolini or Graziani.

In the Balkan mountains it seems that air power should play a great part. Our Hurricane pilots have never felt any exaggerated respect for the Me 109. The Yugoslavs, too, are said to possess from 900 to 1,000 aircraft, with perhaps 450 or more ready for immediate service in the front line. They include Hurricanes, Blenheims, Furies, foreign types and some native designs, one of which, the Icarus, is a twin-engined two-seater fighter with a good performance and good fire power. The *Luft-*



NOT SO HOT: A travelling hot-air oven used by the *Luftwaffe* during the recent wintry weather.

waffe will not have things all their own way.

The rapidity of the German push down to the sea certainly came as a surprise. In this country the public had not expected Salonika to fall into enemy hands so quickly. It had been expected that the R.A.F. would have been able to hold up the German columns in the passes through the mountains where British bomber squadrons, flying Armstrong Whitworths and D.H.4s, did such heavy execution on the retreating Bulgar armies in 1918. Blenheims are much more formidable bombers, but the Germans have got through without apparently having suffered much from Allied air attack. This is certainly bad news, and at the moment it is not possible to foresee what will happen.

Belgrade in Ruins

IT was typical of the Germans to start this campaign by a mass air attack on Belgrade of a particularly savage nature. The ancient capital of Serbia has been laid in ruins, reduced to ashes. The slaughter of civilians must have been appalling. The Yugoslavs had declared the place an "open town," but such a declaration has not the slightest restraining effect on the modern Hun. Whether the destruction of the Capital will have any effect in upsetting the organisation of the Yugoslav plan of campaign cannot be guessed. The ends of many threads are usually congregated in the capital of a country.

The Yugoslavs are not only defending their own country but have also invaded Albania from the north. If this movement is pushed through with vigour it ought to bring most substantial help to the Greek troops, and might even end in the overwhelming of the Italian forces in that country. The Greeks are suffering from sheer shortage of man power, for the population of their whole country is about the same as that of Greater London.

In the midst of so much disturbing news, there is some consolation to be found in the occupation of Massawa by Empire troops. This had, of course, been expected. The Italians now hold only one port on the Red Sea, that of Assab. There is little left of Italian power in Eritrea or any part of Africa, and when the last remnants of resistance have been removed, strong British Empire forces will be set free for work elsewhere, that is to say in the Balkans.

Crossing the Water

ONE very notable failure of the enemy's air forces, Italian and German, was the immunity with which the British troops were conveyed from Egypt to Greece. For weeks past the convoys have been crossing the sea, and the enemy have known all about it. It was impossible that this movement of shipping could have taken place without the air reconnaissance of the enemy discovering the fact. Italian submarines and aircraft (some of the latter probably German) made efforts to interfere. The aircraft dropped bombs and tried torpedo attacks, but the Navy and the R.A.F. provided inviolable protection. Though our Blenheims scored hits on moving Italian warships in the Battle of Cape Matapan, and though in the Sicilian channel the German dive-bombers hit two British warships, the fact remains that for every hit scored on a moving warship a vast number of bombs fall harmlessly into the sea. Air bombing against moving ships seems much like the case of a man out partridge shooting who is a poor shot. If he goes on trying long enough, he is sure to hit a small number of birds, at a great expenditure of cartridges. Ships cleverly handled and escorted by destroyers with good A.A. gunners on board can face the risks of air attack without much trepidation.

We must now wait and see how far Sir Archibald Wavell is prepared to concentrate (to use his word) his troops in Cyrenaica. The Germans in Tripoli have been pressing forward and no doubt would like nothing better than that British Forces in strength should oppose them there. General Wavell is not to be diverted from the more important object. East Africa must be cleaned up and help **must** be sent to the Greeks and Yugoslavs. Even if the enemy should occupy most of what we had gained in Cyrenaica, it will bring him no strategic advantage. He will not be allowed to capture large British contingents in each place; as Sir Maitland Wilson was able to capture Italian prisoners by tens of thousands, he will not rake in masses of useful material, and he will be in no case to make another attempt to invade Egypt. Without command of the sea, the enemy's men in Tripoli must be fairly well cut off from their base, and we shall be able to deal with them when the proper time comes. In the meantime R.A.F. bombers keep up their heavy raids on the harbour and neighbouring aerodromes of Tripoli itself. A squadron of the Royal Australian Air Force is operating in Western Cyrenaica, and one day recently it shot down three Me 110s and three Ju 88s without loss to itself.

Help to the Navy

AN interesting detail about the Battle of Cape Matapan which has since been published concerns the part played by the R.A.F. First, Sunderland flying boats out on patrol on the day before the battle, i.e. on March 27th, spotted some of the enemy ships and reported accordingly. Besides giving this vital information to Admiral Cunningham, the report also brought the Blenheims on to the scene. It has been recorded that they scored hits with their bombs, but a new detail is that after dropping all their bombs the Blenheims continued to make dummy runs over the enemy ships, which caused them to take continuous avoiding action and so lose a lot of speed.

The Fleet Air Arm and the Navy have apparently cleared the Red Sea of Italian destroyers, five of which have been either sunk by our action or scuttled by their crews. In consequence, President Roosevelt has now declared the Red Sea open to American shipping. This will mean a great saving of time in the transport of munitions from America to our forces in Africa and the Mediterranean.

Some details of the great fight for Keren have begun to reach this country, and the following account of the close co-operation of ground troops and aircraft will be read with interest.

"At one minute to seven on the morning of Saturday, 15th March," writes an eye-witness, "a pilot observer and rear gunner peered over the side of their aircraft at the still for-

WAR IN THE AIR (Continued)

bidding Jebels guarding Keren 3,000 feet below. As the pilot banked his aircraft to the right, the stillness was broken by a myriad puffs of smoke from British guns. The assault on Keren, Italy's greatest stronghold in Eritrea, had begun. The pilot flew his bomber over a seemingly unpopulated mountain rock and watched his bombs burst on the forbidding mountain side. He could see nothing of the effect of his salvo but his was the first of a plethora of high explosive bombs that was to help the Army to shake the Italians out of what has been described by mountain warfare experts as the toughest fighting proposition in the world."

Plan of Campaign

THE day before, representative pilots of all the squadrons in the group had been taken to the front in lorries and shown on a large scale relief map made out of sand, just where the Army positions were, just where the enemy lay, and just what was expected of them in their carefully co-ordinated air support. A wonderful thing was that sand map. The front of the towering Jebels up which our troops would have to toil, fighting all the way, on the morrow, was laid out under a screen of camel thorn bushes. On it every peak and pass was clearly labelled. Round it stood pilots listening attentively to a Staff Officer who told them of the army's plans for the attack. "Without the help of you fellows in the air," said the General, "we cannot hope to carry out our plan of campaign."

When that lone aircraft that was over the pass as the battle started returned to its base it was replaced by an endless stream of other aircraft all bent on the reduction of the natural citadel that is Keren. Night and day, without ceasing, tons of bombs fell on the Italian defenders hidden away in their cunningly camouflaged gun emplacements and trenches carved out of the rocks. At all hours during the battle, pilots and crews of aircraft in the Sudan and in conquered Eritrean territory stood by ready to take off for Keren as soon as the signal was given. Bomber squadrons dropped nearly 15 tons of bombs on the first day and made 23 raids during operations which lasted from before dawn to after dusk.

Slowly the news of the battle filtered through. Bulletins were posted on the door of the operations room and tired, dusty, but determined flying crews and red-eyed, blistered ground-crews gathered round to read them. "Bombers appeared to have silenced the batteries behind Sanchil," read the first one. Sanchil was one of the peaks guarding the pass. "Sammanah and Brigs peak successfully attacked and held by us," read the next. Word came through that certain units of soldiers who were holding the fort at Dologorodoc needed food. The bombers loaded up with tinned rations and under fierce fire from Italian batteries dropped the food within a few yards of where it had been arranged. There were no parachute containers handy, so the aircraft came down to within fifty feet from the ground in order to prevent the tins from bursting on impact. Some tins were carried in the bomb racks, and others inside the aircraft." Although many peaks in the hills around were in the hands of the enemy, most of our pilots made two runs over the area, weaving in and out of the valleys until every tin of beef, milk, water and jam was dropped. One man made a special run to drop a packet of cigarettes which he found in his pocket.

The Air Force which played its part in this great Battle of Keren was comprised of squadrons of the Royal Air Force, South African Air Force, and units from Rhodesia.

The Channel and the North Sea

THE German Navy seems to be taking liberties with the Bomber Command. Recently the cruiser *Hipper* or one of her sisters was in Brest harbour, and the R.A.F. naturally made strenuous efforts to plant a few bombs on her. It seems that the ship got away without suffering any crippling injury. One might have thought that her escape would have persuaded the German Navy that Brest was not a very salubrious harbour. But no! The battleships *Gneisenau* and *Scharnhorst*, which had survived various adventures off the Norwegian coast and in the docks at Kiel, and which had, it is believed, been out raiding shipping in the Atlantic, then put into Brest. One of them actually went into dry dock, while the other tied up beside a quay. There was a great prize for the R.A.F. to win! If either or both of these two great ships could be crippled it would be a great step towards Britain winning the Battle of the Atlantic. The Bomber Command naturally did its utmost. A series of raids were made on Brest by numbers of heavy bombers. Helped by the moon and by flares, the observers saw the German battleships clearly, and the air crews came down low with a total disregard for their own safety. Bombs of the heaviest calibre were dropped, and near misses were claimed. It is to be hoped that some of those near misses really did damage the vessels—but the coolness of the Germans in venturing to bring such valuable ships into that harbour is a little upsetting to our own conceit.

It is also to be hoped that worthwhile damage was done at Kiel on the nights when the R.A.F. made its heaviest attacks on that dockyard. One raid continued for five hours, during which 100 tons of H.E. bombs and over 30,000 fire-bombs were dropped. The centre of the town became one vast fire, and it is probable that the work of the dockyard must have been gravely interfered with. U-boats may well have suffered, and the destruction of these underwater craft is perhaps the best help which the R.A.F. can give to the Navy in the Battle of the Atlantic. The next raid was even heavier.

Provinces Again Main Target

CLEARER weather brought the night bombers of the *Luftwaffe* into the air again, and there have been raids on Bristol, Liverpool, Coventry again, and (for the first time) Northern Ireland. Some of the German pilots engaged do not seem to have been of the first order, for many of them avoided the "hot spots" of our defences and scattered their incendiaries and H.E. bombs in open country. By day there has been sporadic raiding at different parts of Great Britain. Of course these raids have caused damage and casualties in places, though the degrees of damage have varied considerably. British night-fighters have also appreciated the moonlight, and have shot down quite gratifying numbers of bombers. On one night the total bag was six, two of which fell to Beaufighters, two to Hurricanes, and one to a Defiant, while A.A. fire claimed another. Another night saw no less than seven raiders destroyed.

During the month of March 4,259 civilians were killed in air raids and 5,557 were detained in hospital. These were classified as follows:—Men 1,956 killed, 3,067 wounded; women, 1,500 killed, 2,077 wounded; children under 16, 598 killed, 413 wounded. The remaining 205 were not classified.

ENEMY AIR LOSSES TO APRIL 5th

	Over G.B.	Over Europe	Middle East
March 30	1	—	—
,, 31	1	—	—
April 1	5	—	—
,, 2	1	—	—
,, 3	2	2	—
,, 4	4	—	—
,, 5	—	—	—
	—	—	—
	14	2	—

Figures for this period in the Middle East are not available. Total in Northern Area, 4,346; Middle East to March 30 about 1,232.

BRITISH AIR LOSSES TO APRIL 5th

	Over G.B. Aircraft	Over G.B. Pilots	Over Europe Aircraft	Middle East Aircraft
March 30	—	—	—	—
,, 31	—	—	3	—
April 1	—	—	2	—
,, 2	—	—	2	—
,, 3	1	1	4	—
,, 4	—	—	3	—
,, 5	—	—	—	—
	—	—	—	—
	1	1	14	—

Figures for this period in the Middle East are not available. Total in Northern Area 1,814; Middle East to March 30 about 133.

FOR STERN PURPOSES : The rear gunner in a power-operated Nash and Thompson turret of a Middle East Wellington. The reflector sight can be seen in the centre panel.

HERE AND THERE

American Tornadoes ?

THE *New York Times* says that the Hawker Tornado is regarded highly in U.S.A. and thinks that the production of Tornadoes in American factories is under serious consideration.

Synthetic Rubber Tyres

THE Goodrich company has produced synthetic rubber tyres of a material called Ameripol and a set is at present undergoing test on a truck at La Guardia Field, New York.

Argentine "Argent"

NOTES to the value of 100,000 pesos (nearly £6,000) were recently handed by an Argentine lady to Sir Esmond Ovey, British Ambassador at Buenos Aires, for the purchase of a Spitfire. The generous donor insisted on remaining anonymous.

Trans-Canada Goes Ahead

TRANS-CANADA AIR LINES carried 788,383 lb. of air mail in 1940, compared with 451,631 lb. in the previous year. Some 53,180 passengers were carried, against 21,596 in 1939, while the year's aggregate for freight of 105,788 lb. was twice that of 1939. Due to extremely adverse weather in the latter part of the month, 4,271 passengers were carried in December, compared with 4,740 in November. The mail load reached a new record, rising 5,000 lb. to 96,000. Freight was 9,448 lb. for the month.

"Contact"

FROM an R.A.F. station in the north has appeared a "house organ" under the name of *Contact* which, in the words of its editor, is "an R.A.F. magazine by airmen, for airmen and of airmen." The idea was born in the minds of one or two enthusiasts who thought that an R.A.F. station of their calibre should have its own journal.

The first number is quite brightly arranged and contains news items of Service operations, extracts from, or abridged versions of articles which have appeared elsewhere, and a humorous section which includes cartoons.

The Simple Starter

THE Piper Coupe and Cruiser for 1941 both have a type of engine starter which in these days of mechanical complication is refreshing in its simplicity. Known as the Hummer, this starter derives its power from rubber cord extending the whole length of the fuselage down to the rudder post. A wire connects the forward end of this cord with gear mechanism attached to the crankshaft. The pilot turns a handle in the cockpit and winds the wire on to a drum for 20 or 30 turns, so stretching the rubber cord. The stored energy is released by pushing the hub of the crank handle forward and the engine is turned over twice. The weight of the starter mechanism is given as less than 10 lb.

Air Navigation Protractor

A PROTRACTOR for navigation use in the air, made up in rectangular form measuring 7½ by 1⅞in., reaches us from Airnay Aids, 2, Raleigh Road, Coventry. The convenience of the navigator has been studied closely in its design, and the track is easily read off by aligning the edge of the protractor along the bearing. Degrees from 0 to 180 are marked on one side in green and from 180 to 360 in red on the other. For use on the 1 : 500,000 map, scales of statute and nautical miles are given, and there is also a quarter-inch to one mile scale as well as a conversion for knots to miles per hour. On one side reminders for dead reckoning navigation are given, and the surface is matt so that pencilled calculations and marks on the scale edge may be made. These are easily removed afterwards by rubber. The protractor is made up in a cardboard case with directions for use, and may be obtained post free for 4s.

SHARE YOUR COPY

SUCH is the demand for *FLIGHT*, it is only by sharing copies with a friend or friends that everybody can be satisfied. Readers can prevent disappointment by adopting this practice more extensively and at the same time help to ease the paper situation.

American "Shadow" Bombers ?

IT is reported that Edsel Ford is discussing a plan with the Douglas and Consolidated companies whereby these two and the Ford company will pool their resources for the production of Consolidated B-24 Liberator bomber.

R.Ae.S. Fellows

THE two latest admissions to the Fellowship of the Royal Aeronautical Society are Mr. A. A. Griffiths, research engineer, and Mr. A. J. Rowledge, consultant engineer, both of the Rolls-Royce company.

Douglasville

SOME idea of the huge extent of the Douglas aircraft factory at Santa Monica is given in the February issue of *Commercial Aviation*, which describes how this plant has been marked off into streets and avenues with appropriate signs at the intersections to enable employees to find their way about quickly.

Modernisation of the trucking system is also to be carried out and will function more or less like a railway system with "trains" of trailer-trucks running to a regular schedule. By this means the flow of materials will be speeded up, and congestion in the aisles relieved.

Canadian Director of Air Services

PROMOTION of Mr. J. A. Wilson, controller of civil aviation, to the position of director of air services of the Department of Transport, was announced in Canada recently. The new director organised the Royal Canadian Naval Air Service in 1918, and was a member of the first Canadian Air Board in 1919. Since 1922 he has been in charge of civil aviation. Born in Scotland in 1879, he graduated at St. Andrew's University and practised in engineering.

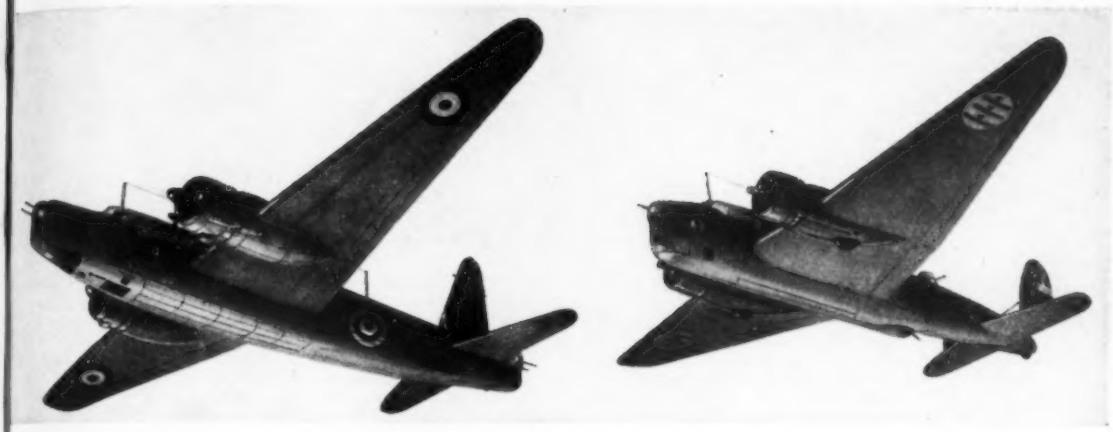
Italian Airline in South America

AN Italian airline, L.A.T.I., operating in South America, has been granted permission by the Argentine and Brazil Governments to commence a service between Buenos Aires and Rio de Janeiro, a distance of about 1,300 miles. One of the conditions imposed is that at least 80 per cent. of the company's personnel in Argentine must be either natural-born Argentinians or naturalised with ten years' citizenship. Another is that all flying personnel must be either Argentine or Italian. The Brazilian conditions are similar. The term of the agreement is for six months, with an option to extend the service over the Andes to Santiago, Chile.

Fifteenth of the Series

FRIEND or FOE?

A Famous British Bomber and an English-looking Italian



Vickers Wellington. Mid-wing, wide span, pronounced taper on both edges, small rounded tips, dihedral from roots. Radial or in-line engines. Gun-turrets in nose and tail, lattice-work cabin windows. Tailplane tapers on leading-edge, inverted "V" fin and rudder of high aspect-ratio.

Fiat Br 20. Mid-wing. Anhedral to upper-surface only of centre-section, normal dihedral outboard of radial engines, pronounced taper on trailing-edge, rounded tips. Gun-turrets in nose, amidships (retractable) and in belly. Tailplane tapers sharply on leading-edge only; twin strut-braced fins and rudders.

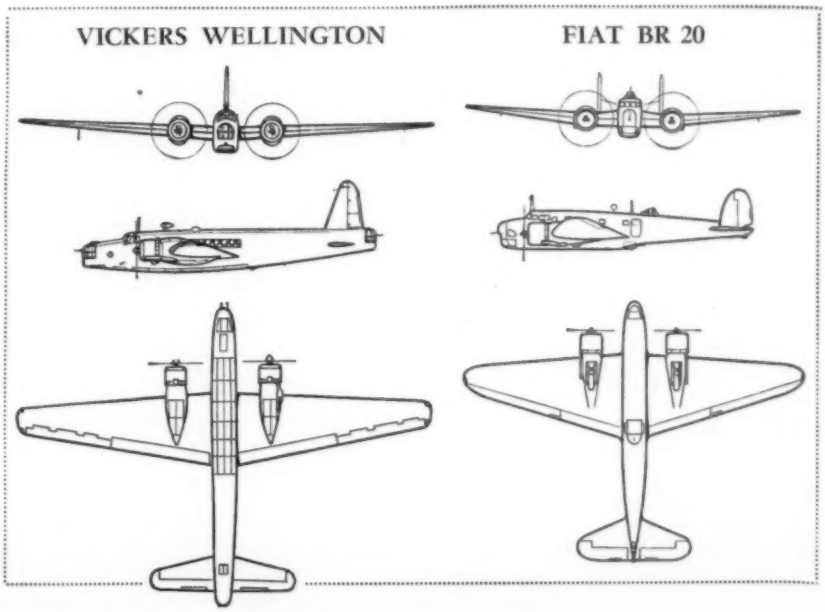
NO British bomber is better known than the Vickers Wellington which, by virtue of its speed and long range, has played a particularly prominent part in giving the enemy some of his own medicine well within his own territory. The Fiat Br 20, a standard bomber of the *Regia Aeronautica* and in large-scale production, has been briefly glimpsed on our home front but found the welcome accorded by Spitfires a little too boisterous to encourage protracted visits. Its general appearance is somewhat English-looking by reason of its tapering wings with rounded tips, radial engines and twin fins and rudders set well inboard from the tailplane tips, but with the exceptions of the Hampden and the Lockheed (with neither of which it could possibly be mistaken) it is smaller in overall dimensions than most twin-tail British and American bombers now in service with the R.A.F.

The Wellington is very easily recognised by its tall, narrow fin and rudder which, set back from the rear extremity of the tail-turret, is strongly reminiscent of a shark's dorsal fin. Its wide-span wings of high aspect-ratio taper gracefully on both edges to small tips and its turreted "snout" projects well ahead of the engine nacelles, which may house either Bristol or Rolls-Royce units. Cabin windows stretch back from just below the pilot's "office" to a point just above the trailing edge and are given a distinctive diamond-pane pattern by the geodetic structure. The top and bottom lines of the fuselage make a clean unbroken sweep from cockpit to rear-turret and the sharp leading-edge taper to the mid-wing tailplane blends with the "dorsal" fin to enhance the graceful proportions of the machine as a whole.

The wings of the Br 20, when seen in plan, have only a slight taper on the leading-edge and, being of deep chord at the roots but with a fairly pronounced taper on the trailing-edge, are of comparatively moderate aspect-ratio.

As in the case of the G 50, the wings of the Cr 20 have a peculiar Fiat characteristic which gives them the unusual appearance, from a head-on view, of being cranked (inverted gull style) on their upper surface only, the engine nacelles being mounted at the "elbows" which is, of course, the point at which the wings proper are attached to the centre-section. (Unlike the G 50, however, the plan view of the Cr 20's wings maintains a uniform taper from root to tip.)

The centre-section, very thick at the roots, slopes downwards on the upper surfaces to the engine nacelles, the underside being level. Outboard of the nacelles, however, there is a normal dihedral of moderate degree. The nose, with its power-driven turret, is slab-sided and there are



FRIEND OR FOE? (Continued)

several square cabin windows just above the wing. The top line of the fuselage is broken amidships by the (retractable) gun-turret and the bottom line is also interrupted by a gun position just aft of the trailing-edge. The twin fins and rudders are shaped like an inverted "U" and are set well inboard upon the tailplane, to which they are braced by parallel struts. The leading-edge of the tailplane is sharply backswept and the trailing-edge straight, the tips being nicely rounded to match the style of the wings.

Types previously dealt with: (1) Hurricane and Me 109. (2) Spitfire and He 113. (3) Beaufort and Ju 88. (4) Lysander and Hs 126. (5) Hudson and Me 110. (6) Anson and Fw 187. (7) Hereford and Do 215. (8) Blenheim and He 111K. (9) Skua and Ju 87B. (10) Swordfish and Ar 95. (11) Sunderland and Do 26. (12) Gladiator and Cr 42. (13) Bombay and Ju 86K. (14) Buffalo and G

(*Next Week: Consolidated Liberator and Focke-Wulf Condor.*)

BOOK REVIEWS

Heroes of the Fighting R.A.F., by Leonard R. Gribble. (George G. Harrap and Co., Ltd. 5s. net.)

OUR reviewer has waded through one chapter of this book, but the flamboyant style overcame him and he says that he cannot face any more of it. He gathers that the author makes Albert Ball, V.C., a member of the renowned No. 60 Squadron at the time of his death. He was not; he was an officer of the even more famous No. 56 Squadron.

"Aircraft of the Fighting Powers." Compiled by H. J. Cooper and O. G. Thetford, and edited by D. A. Russell, A.M.I.Mech.E. The Harborough Publishing Co., Ltd., 10s. 6d.

THIS is a catalogue of the aircraft of the world's fighting powers which is at once comprehensive in range and detail and particularly easy of reference. It contains some 30 British, 20 German and 12 American types, besides the best-known machines of Italy, France, Poland, Holland and Belgium, each of which is illustrated by a photograph and accompanied by drawings showing it head-on, side view and in plan from above. Each machine has a separate page to itself, giving very complete details and comments upon its purpose, development and chief characteristics in addition to the usual data on dimensions, performance, armament and so forth. Opposite each descriptive page is the plan page which, in the case of several of the larger types, is a double or treble folded page.

As a reference book on a subject of paramount interest to-day to everyone in and out of the services and as an identification guide to those responsible for civil defence, this volume will be invaluable.

"A.B.C. of Model Aircraft Construction," by C. S. Rushbrooke. "Solid Scale-model Aircraft," by J. H. Elwell. The Harborough Publishing Co., Ltd., 3s. each.

ALTHOUGH the building of model aircraft, especially flying models, is particularly popular among schoolboys—and never more so than at the present time—the hobby is by no means confined to the very young. For model-making of any kind is an art and a craft as well as a hobby and has ardent devotees of all ages. These two books, therefore, should make a strong and a wide appeal, covering as they do the two spheres into which aircraft modelling falls—that of the flying model and that of the solid scale model. The main object of the constructor in the first case is that his model should *behave* like a real aeroplane, whether or not it be fashioned in the exact likeness of some actual aircraft, but the only object of him who fashions solid scale models is that his product should *look* exactly like the real thing; it is a show piece pure and simple

Obviously two entirely different techniques must be applied (the first requires a fair knowledge of aerodynamics) but both demand a knowledge of the right tools to use and a reasonable skill in their use, which is made easier to exercise if one is acquainted with various little "tricks of the trade." These two books aim at helping the modeller by telling him the right way to tackle the job and they have been written by men with ample practical experience. The flying model has, perhaps naturally, the widest appeal, and Mr. Rushbrooke, who has achieved many successes in competitions and has a reputation for high-quality workmanship, deals with the essentials of construction and design in a simple, straightforward manner that will be a boon to the beginner yet still of value to the more advanced. Indeed, it contains much practical advice, born of wide experience, that even the "old hand" will find helpful.

Both books are generously and attractively illustrated.

"Aircraft Recognition." By R. A. Saville-Sneath. Pengu

FOR those who want a handy, inexpensive aid to the identification of aircraft, this little book will be quite useful, dealing as it does with some 50 or more R.A.F. and German types. It classifies them according to structural features—wing position and design, number of engines, simple or compound tail, etc., with various subdivisions—and the book is generously illustrated with silhouettes and also a series of some 30 photographs of representative types in flight. The author, who is connected with the aircraft industry and has been a member of the Observer Corps since July, 1938, has an intimate knowledge of aircraft design and personal experience in spotting, so he is well qualified to write such a book. He also includes a chapter on the subject of recognition by sound, which makes it clear what a very untrustworthy method this must always be, although certain special types used by the R.A.F.—notably the Harvard—can sometimes be identified by this means. Readers may recall, however, that Sir Philip Joubert, in one of his broadcasts, definitely discounted this method, pointing out that, as two years of scientific research by the authorities had failed to discover any means of positive identification by sound, the unaided human ear was still less likely to be a reliable guide.

Gallantry, by Sir Arnold Wilson, M.P., and Capt. J. H. F. McEwen, M.P. (Oxford University Press. 12s. 6d.)
Ribbons and Medals (Enlarged and revised edition) by Captain H. Taprell Dorling, D.S.O., R.N. (George Philip and Son. 6s. 6d.)

IN time of war decorations are constantly being conferred on gallant members of the fighting Services, and their admirers would be dull indeed if they did not want to understand the conditions of the decoration. Moreover, many elder men have gone back into uniform and wear the ribbons of medals and decorations which sometimes their friends did not know that they possessed. The subject is very much a live one.

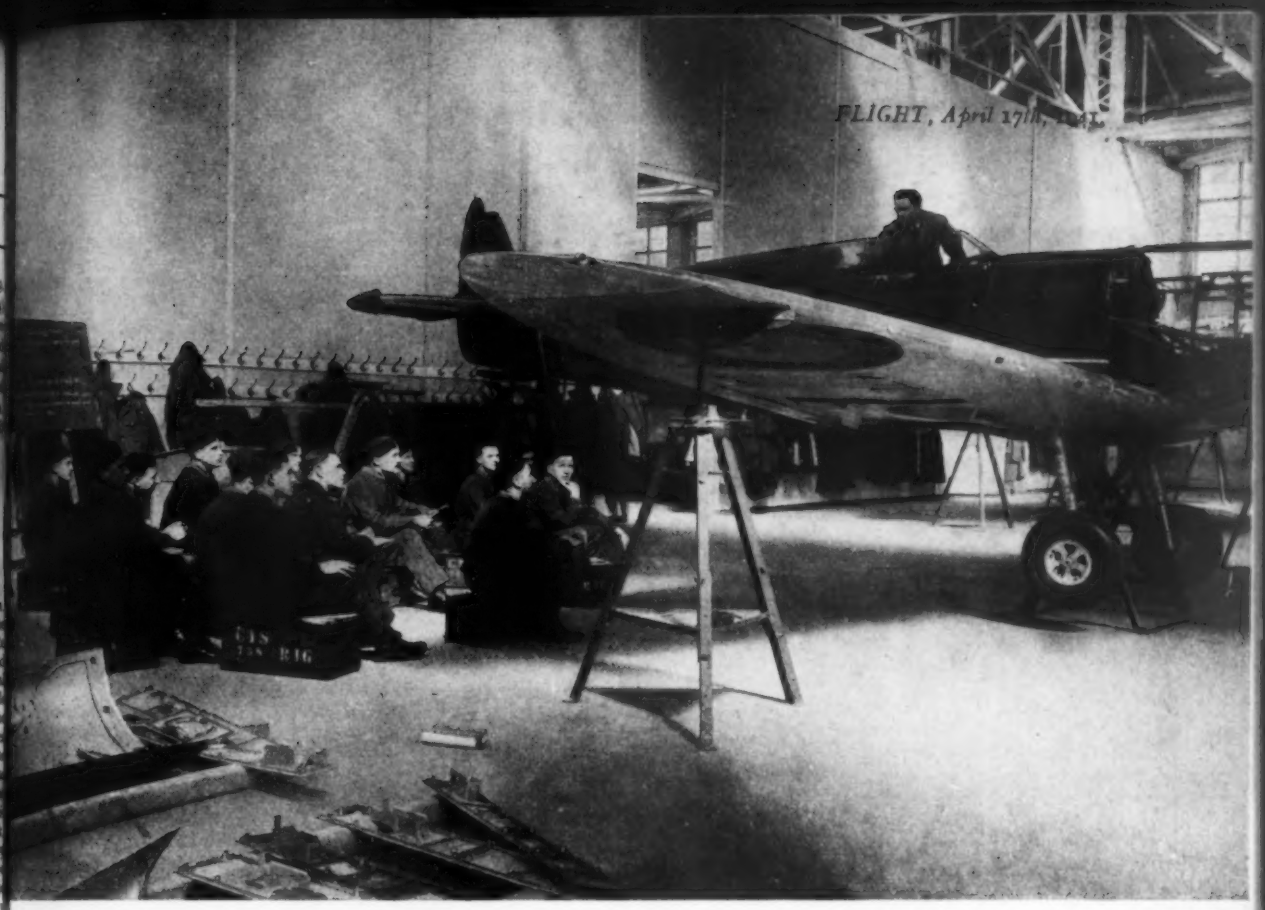
Sir Arnold Wilson and Capt. McEwen have gone into the whole question of gallantry and its recognition in a most comprehensive volume, dealing with civil bravery as well as gallantry in the face of the enemy. In a great number of cases the whole particulars of the deed which won the decoration have been given, and consequently the volume is one of considerable value from the historical point of view.

Capt. Taprell Dorling (more widely known as "Taffrail") has produced a revised edition of his book on ribbons and medals. Its objects are more modest, and the volume handles It deals with the conditions of awards, the insignia of Orders and the precedence of decorations. At the end are coloured plates of many medals and decorations. We have only detected one slip, and it probably is the only one. Officers and Warrant Officers of the Royal Air Force *are* eligible for the Military Cross and it has occasionally been awarded to when employed with R.A.F. armoured car companies.

Australian Engine Factory

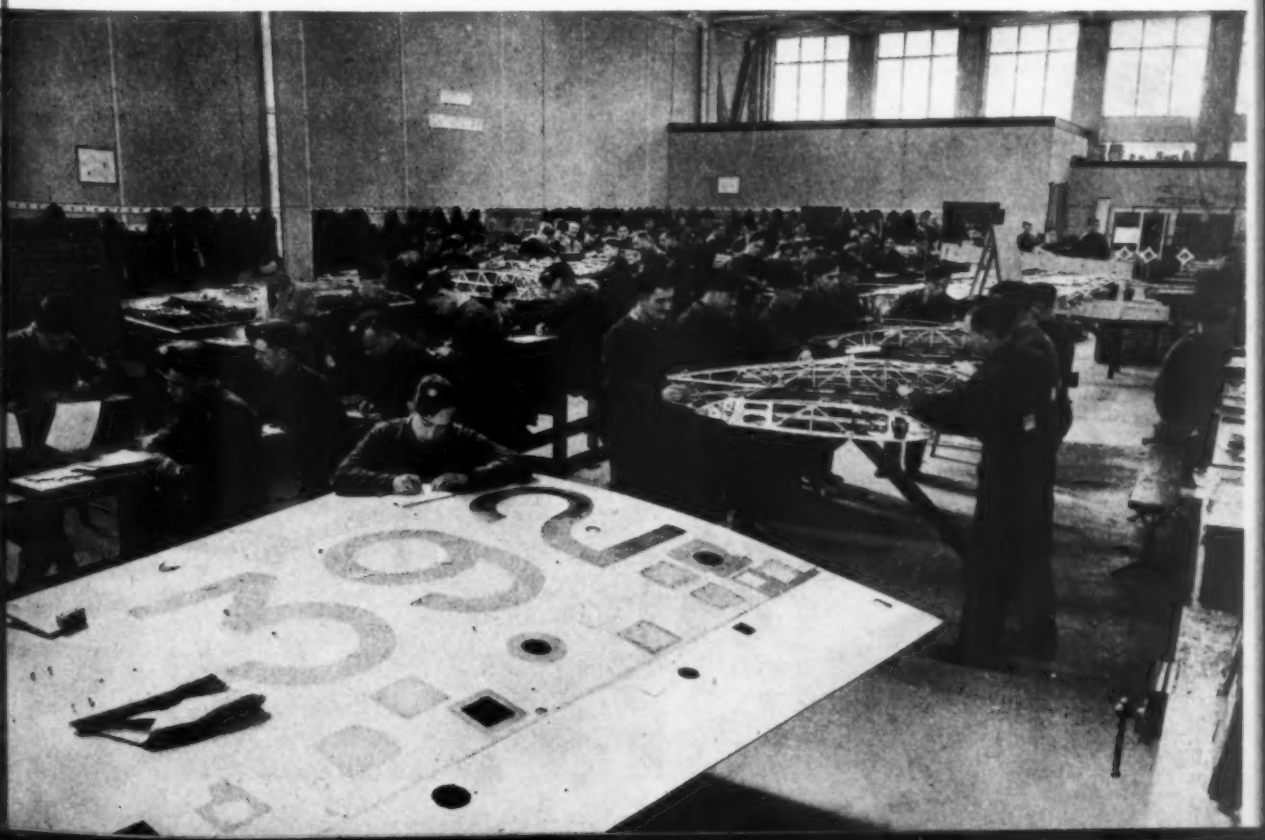
THE Commonwealth Aircraft Corporation has announced that its new aero engine factory at Lidcombe, New South Wales will be opened in April. Selected men will be sent to the Corporation's other factory at Melbourne, which is making Pratt and Whitney Wasps for the Wirraways, for training courses three months.

We believe that the Lidcombe factory is for the manufacture of the Pratt and Whitney Twin Wasps to power the Beaufort which the Aircraft Production Commission is building. It replaces the Bristol Taurus, which cannot, of course, be supplied from this country as was originally intended.



EXPERTS IN EMBRYO

Thousands of men from all walks of life are being instructed as mechanics, fitters and riggers in the R.A.F. training schools, and it is ultimately upon their skill and efficiency in aircraft maintenance that the supremacy of the British fighter-pilot and bomber crew depends. These two pictures were taken at a typical training school in the West Country where men who were, a few weeks ago, behind office desk or shop counter are now proving keen to learn their new job. Above is a class of flight riggers whose instructor apparently finds a Spitfire cockpit a convenient vantage point from which to lecture, while, below, another class is studying the structural details of wings.



NIGHT FIGHTING

Improved Defence

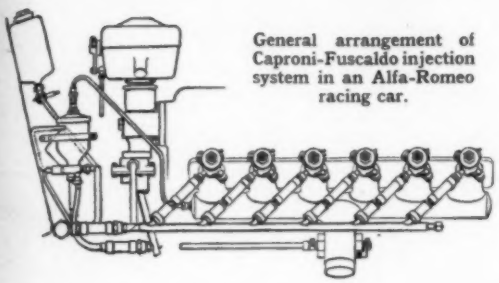
ON the moonlit night of March 13 Fighter Command was able to claim eleven definite victories by night fighters in addition to several probables.

Beaufighters—of which no details may be given and no photographs published—Defiants, Hurricanes and Spitfires as well as Fighter Blenheims are all employed in chasing the *Luftwaffe* after sunset. One squadron of Beaufighters alone destroyed four raiders, and the squadron leader of this unit had, himself, three moonlight encounters. A flight lieutenant of the same squadron, describing his first night victory, said, "It looked just a little black spot silhouetted against the haze. Coming up behind him I gave one burst and something fell off the bomber. I was immediately enveloped in a blinding cloud of smoke, and when I flew out of it the bomber was already on its way towards the sea well alight. I was so excited that when I landed I found myself perspiring as if I had been in a Turkish bath, although it was very cold.

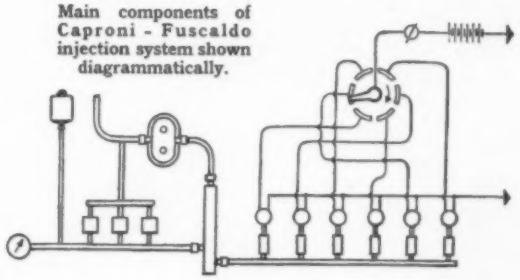
The photographs on this page show: A Hurricane running up in a floodlight; Boulton Paul Defiants lined up on the grass with a close-up of the four-gun turret in the left bottom corner, and a typical scene in the crew room where night-flying pilots wear dark glasses in order that their eyes are pre-accustomed to seeing in poor light. It is of interest to note that some of the pilots are wearing the new R.A.F. battle dress.

ELECTRIC PETROL INJECTION

A Successful Car System which Might Be Applied to Aero Engines



General arrangement of Caproni-Fuscaldo injection system in an Alfa-Romeo racing car.



Main components of Caproni - Fuscaldo injection system shown diagrammatically.

WE are indebted to Mr. E. J. Appleby, Editor of our associated journal *The Autocar*, for reminding us of a system of direct petrol injection which was used with success in an Italian racing car some time ago. The car was a 2½ litres Alfa-Romeo, which took part in the 1940 *Mille Miglia* and finished well up after an absolutely trouble-free run.

This system is known as the Caproni-Fuscaldo, the basic principle being the very simple one of an external tube containing a very small and light valve operated electrically. The system can, apparently, be operated in two distinct ways: either the injection valve can be placed in the branch of the induction pipe, immediately before the inlet valve, or a small pipe can be led direct to the cylinder wall, somewhere in the combustion chamber. In the Alfa-Romeo car the former arrangement was used, and this is obviously the simpler of the two, but possibly not the most efficient for aircraft work. When the injector is placed in the induction pipe, the valve opens during the induction stroke and the petrol mixes with the incoming air, being admitted to the cylinder through the inlet valve. If the direct injection system is adopted, the injector can be made to deliver the petrol during the compression stroke, the action being then more comparable with diesel practice, although the compression pressure against which the fuel is injected is, of course, a good deal lower (a compression ratio of 6 or 7 to 1 as against about 16 to 1), and spark ignition is used.

The fundamental advantage of the Caproni-Fuscaldo scheme seems to reside in the use of the small electrically operated valve of the injector. No valve dimensions are available, but it is known that in the injectors used in the Alfa-Romeo car the valve lift was only 0.2 mm., and as the valve was very light, operating speeds were not limited by inertia forces.

Briefly explained, the Fuscaldo injector valve is housed in a small tube, and above it is a small elector magnet. Electric current (from any existing source on the car or aircraft) is passed to the magnet via a distributor, which can be run off the camshaft. When current passes, the valve is lifted instantly, and as soon as the current is cut off by the distributor arm leaving the segment, the valve closes under the pressure of a spring, and the fuel is cut off. Obviously, the timing of the injection can be controlled by the distributor, and the amount of fuel admitted can be governed by controlling the amount of valve lift, either automatically or by hand. It is claimed that accurate control of fuel admission has been obtained down to periods as short as 1/1,000th of a second.

For direct injection into the combustion space, a more powerful pump is evidently needed to deliver fuel to the injector valves, but, as mentioned above, the compression pressures in aero engines are not as high as those encountered in diesel engines, and there should be no difficulties on that score. It does appear that the Fuscaldo electrically operated injector valve would be worth serious study with a view to applying it to aero engines. As previously mentioned in *Flight*, there is much to be said for direct injection.

British Airways' Coat-of-Arms

BRITISH Airways now has a coat-of-arms and this consists of two winged lions supporting a shield which carries a helmet. One is a "land" lion and the other—well, sea-lion is hardly the word as this conjures up a vision of a black smelly thing which eats fish, grunts, and at the end of its life produces an expensive coat. Actually the animal is an amphibian—but it would be best to let the heraldic explanation tell the story.

The supporters are two winged lions, one standing on the ground and the other on the sea, representing our land and sea Services respectively. These two winged lions are wearing collars, denoting control; that is, controlled flying as well as some form of official control.

The shield is composed of a winged lion's face wearing an astral crown. (This, by the way, should not be described as a winged lion's head, as that, according to the rules of heraldry, would have to be in profile the same as the supporters.) The astral crown, recently designed for use in heraldry, symbolises achievement in the realm of the air. It has four stars, each between wings conjoined at the base. The helmet resting on the shield is that used in heraldry by corporations and public utility companies. The helmet must always remain in profile, even if the design is changed. The crest is placed on a wreath of the corporation's "livery" colours, which are gold and blue. The clouds above the crest are represented in the conventional heraldic manner. The mantling below the wreath is a decorative adjunct to the achievement and has no special significance.

C.P.R. Entering Air Transport Field

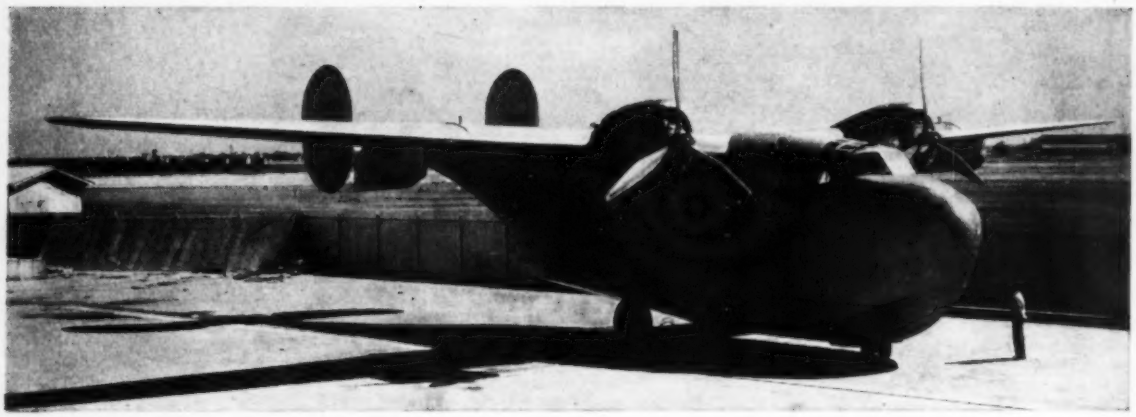
VISIONS of a single company flying Canada's northland from Atlantic to Pacific and using this territory as a base for flights by way of Alaska to Asia, are seen in the reported purchase by the Canadian Pacific Railway of six of the largest northern Canadian air transport operators, whose services range from Quebec to the Yukon. The Canadian Pacific Railway is reported to have bought controlling interest in Yukon Southern Air Transport, operating from Vancouver and Edmonton by way of northern British Columbia to Dawson, Yukon Territory; Ginger Coote Airways, operating on Vancouver Island; Mackenzie Air Service, operating from Edmonton along the Mackenzie River to Aklavik and other posts north of the Arctic Circle; and to be negotiating for the purchase of Wings, Ltd.; Starratt Airways and Airways, Ltd., all operating in northern Ontario and northern Manitoba.

The Canadian Pacific already has control of Canadian Airways, Ltd., a company operating northern services from Quebec to the Mackenzie River. The Canadian Pacific Railway has had an eye on aviation for a number of years, but the decision of the Canadian Government that inter-city air transport should be publicly owned, which decision led to the formation of Trans-Canada Air Lines, has left the Canadian Pacific out of air transport. With Canadian Airways, Ltd., bought over a year ago, Canadian Pacific made its main entry into the business, and now is reported to be spending $12,000,000 to consolidate northern air services and then run an airway out of Vancouver via Alaska to Siberia, Moscow and Shanghai, as part of an international service. Such a service would help to put one more ring around the earth.

THE FOWLER FLAP

The History and Applications of a Well-known American Type of Wing Flap: Wing Loadings of 75 Pounds per Square Foot Predicted

By HARLAN D. FOWLER



The Consolidated 31 flying boat has a wing-loading of 48 lb./sq. ft. Its take-off and landing runs are kept to reasonable length by means of Consolidated-Fowler wing flaps.

SINCE its conception in 1916 the development of the Fowler flap principle has passed through practically every known stage of the proverbial struggle of an invention conceived ahead of its time. In fact, twenty years passed before its first practical application to extensive commercial use. It may be interesting to briefly review this transition period.

The greatest difficulty surrounding the acceptance of a high lift device prior to about the year 1930 was the almost universal use of the biplane type of wing construction. The wing loading was low, ranging from 6 to 15 lb./sq. ft., representing wing surfaces of extremely large proportions compared to present-day practice. Now the basic principle of the Fowler flap is (1) variable area, (2) variable camber and (3) a gap between the wing and fully extended flap. The combination of these factors was obtained by extending a separate airfoil surface from its closed position under the trailing surface of the wing rearwardly and downwardly. This increased the chord of the wing. The aerodynamic effect was to so increase the circulation of the air around the wing as to increase its lifting power. So large is this increase in lift under certain designed conditions, such as a 40 per cent. chord flap over the entire span of a wing, that the maximum lift of a normal wing is increased as much as 2½ times. Despite these known facts it was practically impossible to break through the apathy towards the acceptance of the monoplane type of wing construction, because it was by virtue of this extremely high increase in lift of the Fowler flap that it was possible to substitute a monoplane wing for a biplane. (Surely it would be more correct to say that it is high wing loading, not monoplane construction, which has been made possible by the use of flaps?—ED.) Anyone familiar with the pioneering efforts of Anthony Fokker and Bellanca in introducing the monoplane would understand this situation.

THE Fowler flap first came into world prominence when fitted to the Lockheed 14, that very useful civil airliner which was developed into the equally useful Coastal Command reconnaissance bomber, the Hudson. The Lockheed 14 appeared in 1937, so the author's statement that the principle of the flap was conceived in 1916 will come as a surprise to most people. The article is printed by courtesy of the Consolidated Company's journal, "Consolidator"

Realising the importance of providing by actual flying demonstration the economic advantage of the Fowler flap, the writer constructed a monoplane wing incorporating this device. An old-type Canuck aeroplane was obtained, its biplane wing of 330 sq. ft. area was removed and the monoplane wing of 136 sq. ft. normal area, extended area 166 sq. ft., substituted. The test flight showed that the landing speed was about the same in both cases, but the top speed increased from 90 to 100 m.p.h. This increase in speed was equivalent to changing the power of the engine from 90 to 135 h.p. These flight tests were made in 1927, and substantiated again in 1929, when the same wing was installed on a Pitcairn PA-3.

It was not until 1934 that substantial progress was made. In that year a Fairchild F-22 was equipped with a specially designed wing and delivered to the Bureau of Aeronautics. This aeroplane had the unique experience of being tested in the National Advisory Committee for Aeronautics 60-foot wind tunnel and then subsequently flown. As compared to the original F-22 aeroplane the stall speed was reduced 7 m.p.h., the high speed increased nearly 4 m.p.h., and both the take-off and landing distances considerably reduced.

Other Types of Flap

In the same year, during the Fourth International Competition at Warsaw, the Fieseler Fi-97 took 5 of the 14 first places. The remarkable feature of this aeroplane was the use of full span Fowler flaps in combination with a new type of lateral control. This development was done in Germany.

It should be noted here that the monoplane idea was

The Lockheed Hudson and its civil forerunner, the Lockheed 14, both have distinguished records. The first commercial installation of the Lockheed flap was made on the Model 14 when it appeared in 1937.

(Below) The Ryan YO-51 was designed for army co-operation and artillery observation. Reminiscent of the Handley Page Gugnunc, the Ryan achieves its low stalling speed by the fitting of full-span slots and Fowler flaps of very wide chord. The performance of this aeroplane has not yet been released by the U.S. Army Air Corps, nor have the details of its lateral control device. Span is 52ft., chord 7ft. 8in., length 34ft. 5in., and the engine is a Pratt and Whitney Wasp of 420 h.p. driving a Hamilton variable-pitch airscrew. The total loaded weight is 3,900 lb.

THE FOWLER FLAP (Continued)

emerging very rapidly after 1930, and it is beginning with this fundamental change in aircraft design that flaps of various types began to receive attention. It is believed that Northrop was the first one to apply the split type flap to production aeroplanes. (It is interesting at this stage to remember that the Fairey flap, a hinged trailing edge variable-camber device, was first fitted to a Fairey seaplane in 1916.—ED.) The split flap was one of the last inventions of Orville Wright, one of the original inventors of the aeroplane. The split flap was a plain plate deflected below the trailing surface of the wing, and its chief advantage was to reduce the speed and landing run on the ground. It had no beneficial result in improving the take-off run. As already shown, the Fowler flap had all-round advantages and particularly the large reduction in take-off run.

So in 1937 appeared the first successful commercial application in the well-known Lockheed 14, the type in which Howard Hughes flew round the world in four days.

In 1939 appeared the Consolidated Model 31, the first seaplane on which Fowler flaps were used. When loaded to carry 45 lb./sq. ft. the stall speed was reduced 28 m.p.h. by means of the flaps and without the use of power.

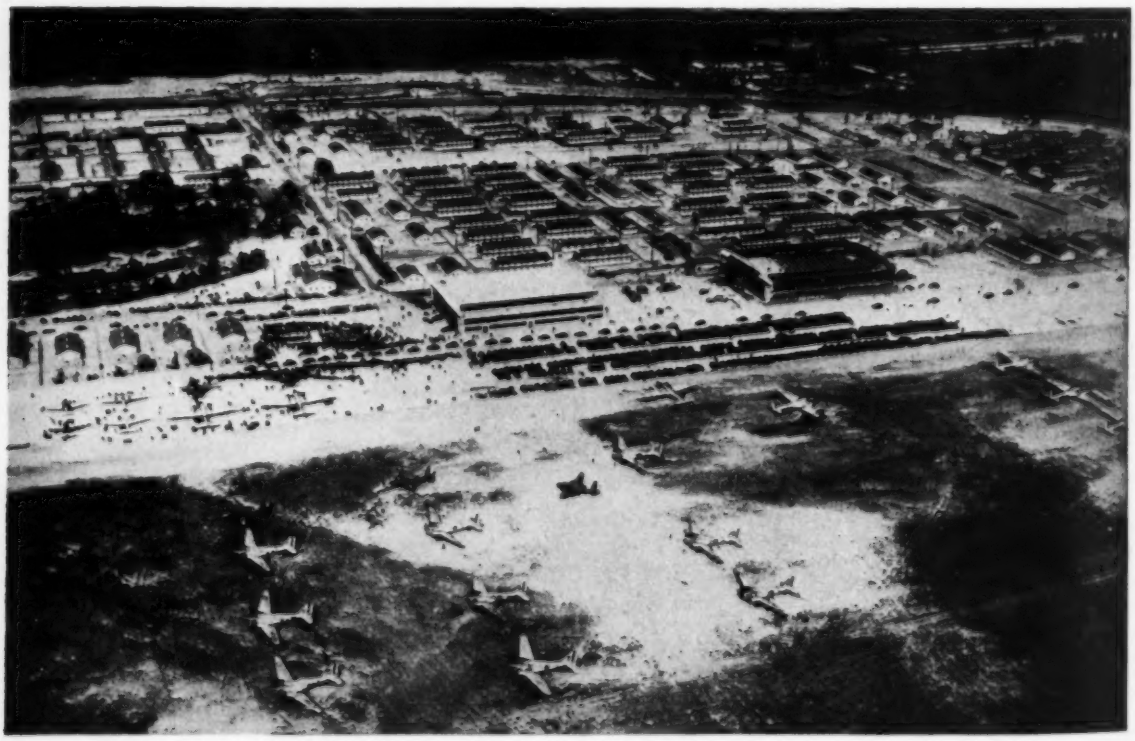
More Developments to Come

One of the outstanding spectacular feats of 1939 was the flying from Los Angeles to New York in about 7 hours of the Lockheed XP-38, the 400 m.p.h. version of the latest type of pursuit for the Army, the fastest long-range weight-carrying military aeroplane in existence to-day. (There are comparable British types.—ED.) In spite of its high-wing loading the take-off ground run and distance to clear a 50-foot obstacle is reduced approximately 30 per cent. by using the flaps in the extended position, as compared with the flaps retracted.

Another unusual development also took place in 1940 with the appearance of the Ryan YO-51 (see photo on page *g*). This model was the second type to use full span Fowler flaps with a special type of lateral control device. Many who have witnessed its uncanny slow hovering speed foresee the possibility of the long-discussed safe aeroplane.

In between each stage of a new aeroplane using the flaps are records of exhaustive wind tunnel research on the part of various manufacturers to determine the best type of flap to use. This research is still continuing, and from the successful application so far made it is believed that the Fowler flap is here to stay for a long time, because we are still far from utilising the tremendous increase in lift obtainable with this flap. This is predicated on the fact that the weight of sustained load per square foot of wing area is increasing. In other words, the wing surfaces are being made capable of carrying larger and still larger loads per square foot of area. For instance, in 1930 the weight carried per square foot was about 15 lb., in 1935 it was about 25 lb., in 1937 it went to 32 lb., and in 1940 it is over 40 lb. In Howard Hughes's aeroplane it was loaded to 48 lb. (and the Consolidated 31 flying boat also reaches this figure.—ED.) This rapid increase in wing loading is what makes possible the phenomenally high speeds we are getting to-day—while still retaining a safe landing speed. It is quite possible that by 1945 we shall see aircraft capable of carrying 75 lb. per square foot with safety.

Large aeroplanes of 20,000 lb. and over are particularly susceptible to advantages to be derived from the Fowler flap, because the cost and weight of such installation becomes progressively small compared to the complete aeroplane due to the fact that the size of the wing can be so reduced as to actually result in substantial savings in both categories.



THEY'VE GOT SUMP'N THERE! In the short space of 90 days the new U.S. Army air base at Savannah sprang into being on what had previously been a tract of waste ground—quick work even for America! This picture, taken during the opening ceremony, gives a good idea of the size of the place which has 182 buildings and accommodates some 4,000 personnel.

EXHAUST EFFLUX PROPULSION—V

About Ten per Cent. of Engine Power Available for Auxiliary Propulsion

By
F. W. LANCHESTER, LL.D., F.R.S.

THE first four articles of this series were published in our issues of Nov. 16th and 23rd, and Dec. 7th and 14th, 1939. In this, the final, analysis Dr. Lanchester gives a generalised solution, the final results being tabulated and given in the form of diagrams. The article also contains a brief review of method as applied to the condition of supercharging, which was not touched upon in the first four articles.

IN the previous articles* the writer confined his attention to the normal condition of operation without "boost"; the question of supercharge in its relation to exhaust efflux propulsion was not considered. The writer reached his main conclusions on the understanding that the "tail of the diagram" is the measure of the energy available, subject of course to deductions or allowances to account for unavoidable losses.

Referring to Fig. 1, for an engine *without supercharge* the area ADF represents the work available in the "tail" in terms of the area ABCD which represents the work done in the motor cylinder. The graph DF represents the continued expansion of the charge to atmosphere, when normally it would be expelled after release at D at about 40 lb./sq. in. above atmosphere. Those pioneers of bygone days who attempted the compounding of a gas engine, envisaged this continued expansion as taking place in a low-pressure cylinder. The modern idea is to make use of this energy in a quite different manner, namely, by imparting a high efflux velocity to the exhaust, which, directed backwards, acts after the manner of a reaction turbine, and supplies a supplementary force of propulsion. The relation between the areas ADF and ABCD does not much depend upon the actual pressure of the atmosphere in which the engine is put to work, provided there is no supercharge, and as an average figure (at full open throttle), this relation, in the previous articles, was taken to be 20 per cent., which is never far from the truth. In the Figure, which has been carefully plotted on the data given, the relation (calculated) is 19.5 per cent.

It is hardly necessary to state that when there is supercharge this average figure will not apply, and the relation will in every case need to be calculated according to the degree of "boost" specified. To take an example let us suppose that an aeroplane designed to operate at an altitude of 20,000 to 25,000 feet, where the pressure is about half that at sea-level, be furnished with a compressor designed to give an increase in the relation of 1 to 2, that is to enable the engine to give its normal low-level performance. The expansion may now be carried much further. Thus, referring to the figure in which the two-to-one condition of supercharge is illustrated, the expansion will not cease at F but will continue to a point J, and the "tail" of the diagram will comprise the area JADJ, which is calculated as the area LHDJ — (KHAE + LKEJ). At this point

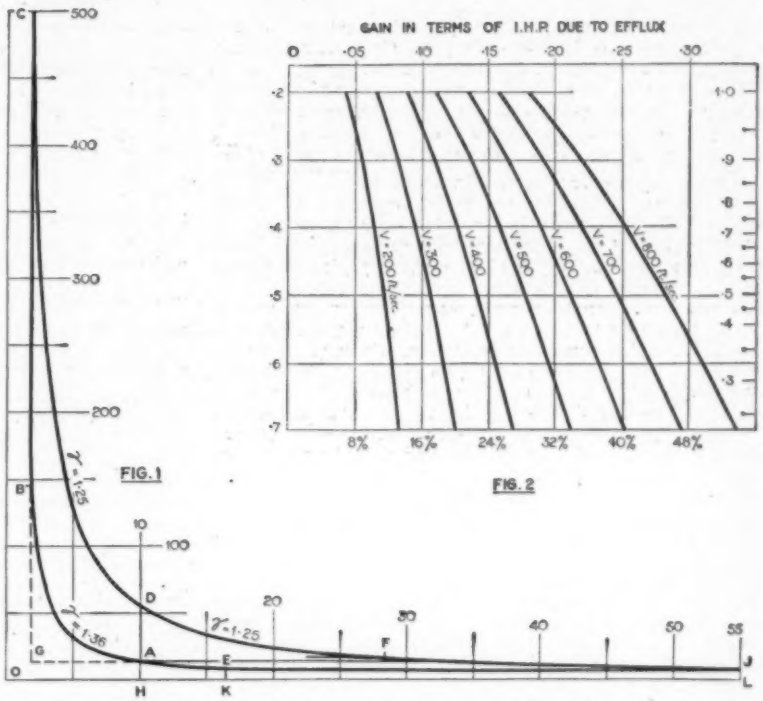


FIG. 1

FIG. 2

Fig. 1. Theoretical Indicator diagram under supercompression; "boost" ratio 2 to 1. Expansion shown carried down to lower atmospheric level, line EJ, being 6.5 lb./sq. in. The upper level, 13 lb./sq. in., is taken as induction pressure at point A as representing ground level conditions. The pressures and volumes at different points in the cycle are given, as calculated in Table I.

Fig. 2. Graphs showing "Gain" in terms of i.h.p. (upper scale) and in terms of thrust h.p. (lower scale) are given on the assumption that there is no loss of energy *in the act of ejection* (jet friction, etc.) The graphs are plotted for flight speeds ranging from 200ft./sec. to 800ft./sec. The scale on the right hand gives the *inverse* of the supercompression ratio; thus the mark at 0.25 near the bottom of the diagram corresponds to a supercharge ratio = 4 to 1. The scale on the left hand gives the relation of the "tail" area to the area of the diagram proper, namely ABCD (Fig. 1) to correspond.

a brief explanation is necessary. The pressure at A is taken to be 13 lb./sq. in., that being the approximate effective atmosphere at the end of the induction stroke when the return stroke begins. Similarly the pressure along the line JE is assigned half that value, namely 6½ lb./sq. in. This preserves the area of the diagram as representing work done in the motor cylinder ABCD as unaffected by altitude for the case taken.

According to the above regime, in which the expansion is carried down to 6.5 lb./sq. in. at J, the exhaust will take place at that pressure, back as far as E, at which point the "boost" or preliminary compression begins, the pressure rising to 13 lb./sq. in. at A. At this point the usual convention is adopted. The exchange of exhaust gases for fresh charge is not shown, although this involves a negative loop in practice†.

The data on which the Fig. 1 is founded, and the calculated numerical values, are given in Table I. The significant result is that in this particular case the energy available in the "tail" of the diagram JADJ is almost exactly 50 per cent. of that in the diagram ABCD. This takes the place of the 20 per cent. ratio hitherto assumed as applying to an engine without supercompression. Then, taking the remaining data as previously (*Flight*, Nov. 23rd, 1939) velocity of flight V = 400 ft./sec. Work done per second in motor cylinder = 70,000 ft. lb.; 1 lb. charge will be taken as yielding 250,000 ft. lb. energy in the motor cylinder,

* *Flight*, Nov. 16, 23; Dec. 7, 14, 1939.

† Compare Journal R.Ae.Soc. May and June, 1937; or reprint No. 86, p. 40, Fig. 24.

EXHAUST (Continued)

and the whole of the " tail " energy will be taken as available to appear as kinetic energy in the efflux stream: subject to subsequent allowance for losses.

Then, the mass of the charge, and therefore of the efflux gases, will be 70,000/250,000 = 0.28 lb. per sec.; and on the 50 per cent. basis the energy in the " tail " = 35,000ft./lb. per sec. In the equation $v = \sqrt{2gs}$ s = 35,000/0.28 = 125,000ft. Hence $v = \sqrt{64.4 \times 125{,}000}$ = 2,840ft./sec. Thus by the rocket equation $2V/v$, the effective efflux efficiency is 800/2,840 = 0.281, say 28 per cent. And 0.28 × 35,000 = 9,800ft. lb. available. Thus " gain " in terms of engine i.h.p. = 9,800/70,000 = 14 per cent.

In the earlier articles reasons were given for discounting this figure owing to losses which must be regarded as unavoidable. As a provisional estimate, which is, in truth, little more than a " considered guess," the writer assumed that not more than half the energy theoretically available could be usefully directed; in other words the efflux velocity as calculated must be reduced in the ratio $\sqrt{2}$: 1. On this basis the effective efficiency as given by the rocket equation becomes 800/2,000 = 0.4 or 40 per cent. But now the energy is only half, so that the available energy is, 0.4 × 17,500 = 7,000, that is to say 10 per cent. of the engine i.h.p. That is the writer's expectation of the practical limit of exhaust efflux auxiliary propulsion *on the data above assumed...*

In order to add realism to the discussion, the diagram given in Fig. 1 may be considered as relating to an engine of approximately 5in. bore by 5in. stroke, containing 100 cu. in. stroke volume, giving a cylinder constant = 100/12 = 8.3 units of 12 cu. in. The compression ratio being 0.17, the total volume is 8.3 + 1.7 = 10, which is the volume given at points A and D in the figure, and used in the numerical calculations. Working under normal sea-level conditions, the initial induction pressure being taken at 13 lb./sq. in. the calculated mean pressure is 107. and the ft. lb. per working stroke 107 × 8.3 = 888 (more exact calculation gives the figure as 889). The detail results of calculation are given in Table 1, founded on gamma values, compression E to B, $\gamma = 1.36$ and for expansion C to J, $\gamma = 1.25$.

TABLE I
Data Relating to Diagram Plotted.

	Pressure per sq. in. (absolute)	Volume 12 cu. in units	Calculated Areas M.P. × Volume Giving Energy in ft. lbs.
A	13	10.0	A B C D = 889
B	145	1.7	
C	500	1.7	H D J L = + 760
D	54.7	10.0	H A E K = − 61
E	6.5	16.6	K E J L = − 250
F	15	28.2	J A D J = + 449
G-A	6.5	8.3	J A D J / A B C D = 449/889 = .505
H	0	10.0	
J	6.5	55.0	Say 50%
K	0	16.6	(Without Supercharge
L	0	55.0	F A D F = 173)
Compression $\gamma = 1.36$			F A D F / A B C D = 173/889 = 19.5
Expansion $\gamma = 1.25$			
Mean Cylinder pressure			A B C D = 889/8.3 = 107 lb. sq. in.

Having dealt with a special case by the same procedure as previously adopted, the way has been prepared for the problem to be treated in more general terms.

Symbols :—

V = velocity of flight : ft./sec.
T = thrust in lb.
W = work done in cylinder, ft.lb./sec. (indicated).
η = mechanical efficiency of engine.
ϵ = efficiency of propeller.
R = ratio of " tail " area of diagram to area of cylinder diagram : i.e. energy relation.
E = Energy ft. lb. exhibited in cylinder diagram per lb. of charge.
m = mass per second in efflux gases.
v = efflux velocity.
s = " head " or height in feet corresponding to efflux velocity.

Then, $VT = \eta\epsilon W$ or, $W = \frac{VT}{\eta\epsilon}$ and RW = work done per sec. as represented by " tail " of diagram = $\frac{RVT}{\eta\epsilon}$

and $m = W/E = VT/\eta\epsilon E$ $\therefore s = \frac{RVT}{\eta\epsilon} \times \frac{\eta\epsilon E}{VT} = RE$.

Then $v = \sqrt{2gs} = \sqrt{64.4\ RE} = 8\sqrt{RE}$ and efflux efficiency (by the rocket equation) = $2V/8\sqrt{RE}$ $\therefore$ the work available for efflux propulsion will be $RW \times \frac{2V}{8\sqrt{RE}}$ = $\frac{V\sqrt{R}}{4\sqrt{E}} \times W$. Or in terms of W the available efflux energy is $\frac{V\sqrt{R}}{4\sqrt{E}}$

Applying this to the special case just dealt with, we take as before, V = 400ft./sec., E = 250,000ft./lb. and R = 0.5, then the work done by the exhaust efflux in terms of W (the engine power) is :—

$\frac{400 \times 0.7}{4 \times 500}$ = 0.14 or, 14 per cent., which is the result for this particular case already given.

In Table II and Fig. 2, corresponding values are given as calculated from the above equation, for data ranging from V = 200ft./sec. to 800ft./sec., and values of R from 0.2 to 0.7. The value of R depends upon the degree of supercharge; R = 0.2 corresponds to the condition of no supercharge; R = 0.5 corresponds to supercharge in the relation of 2 : 1; and R = 0.7 to a degree of supercharge approximately in the relation of 4 : 1. To make this clear a scale is given showing the pressure *without* supercharge as unity; and the lower pressures at which the air enters the compressor corresponding to R values. Each graph in Fig. 2 relates to a definite value of V. Abscissae (upper scale) give " gain " in terms of indicated h.p., as calculated. The lower scale gives " gain " as a percentage, in terms of thrust h.p., the value of $\eta\epsilon$ being taken = 62.5 per cent.

The figures given are as calculated; there has been no deduction for losses of any kind.

TABLE II

V =	200	300	400	500	600	700	800	
.2	.044	.066	.088	.111	.133	.155	.177	13.0
.3	.055	.082	.109	.136	.164	.191	.218	11.8
.4	.063	.094	.126	.157	.189	.221	.252	9.3
.5	.071	.106	.141	.176	.211	.246	.281	6.5
.6	.077	.116	.155	.193	.232	.271	.310	4.3
.7	.083	.125	.167	.209	.250	.292	.334	2.9

If we denote the mechanical efficiency of efflux by the symbol u the energy *available on the jet* from the " tail " of the diagram will be uRE (instead of RE), then, since $W = VT/\eta\epsilon$, $uRW = uRVT/\eta\epsilon$ and as before,

$s = \frac{uRVT}{\eta\epsilon} \times \frac{\eta\epsilon E}{VT} = uRE$, $v = \sqrt{2guRE} = 8\sqrt{uRE}$

Hence " rocket efficiency " = $\frac{2V}{8\sqrt{uRE}}$

and net work available = $uRW \times \frac{2V}{8\sqrt{uRE}} = \frac{V\sqrt{uR}}{4\sqrt{E}} \times W$

Thus the values given in Fig. 2, need to be multiplied by $\sqrt{u}$ to give the net available gain in terms of W, in order that allowance be made for the mechanical efficiency of the efflux jet. If, as tentatively assumed above, $u = 0.5$ the expected net gain in terms of thrust h.p. will be given by multiplying the figures in the lower scale by 0.71

"DOPE"

From Cellulose Acetate to Synthetic Finishes: Changing Requirements Produce New Materials and New Methods

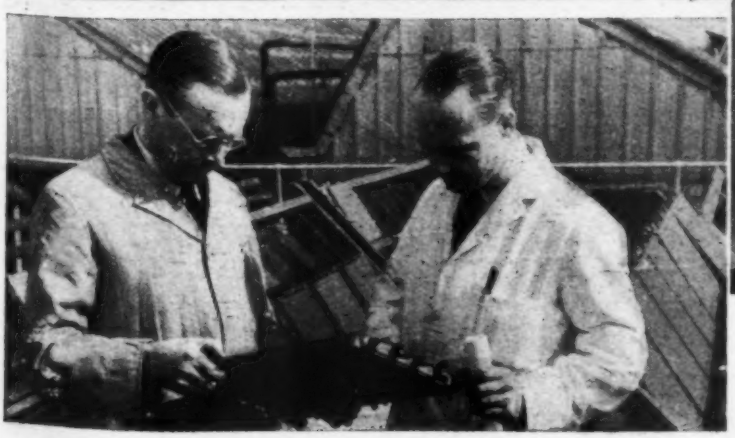
ON March 7th of this year it was thirty years since the manufacture of aeroplane dopes began in a very small way. The history of "Cellon" is outlined in the following notes

THE very earliest of British aircraft pioneers had many problems to solve. Not only were they almost entirely "in the dark" as regards aerodynamic efficiency and structural strength, but no information was available concerning the proper methods of making their wings retain that aerofoil section which they had designed with so much loving care. All manner of expedients were tried. Some stitched linen fabric on the wings, and then attempted to make the fabric airtight by brushing some concoction such as sago, tapioca or glue into the linen. A. V. Roe (now Sir Alliott Verdon-Roe), ever ingenious, used a stiff packing paper on his earliest aeroplanes. This paper had one side coated with some glossy substance, but it would not remain taut nor, or course, was it waterproof.

This state of affairs continued for two or three years, and then appeared on the scene a young aviation enthusiast by the name of Wallace Barr. He had got hold of a recipe for a preparation which would not only make the fabric covering waterproof but, what was better still in those days, when no one flew in bad weather anyway, it would tighten the fabric. Few were the aerodromes in those days at which Mr. Wallace Barr did not appear with his doped panels, and few were the designers who did not tap interrogative fingers on the panels to hear them ring. Sometimes a doubting Thomas would object that there was no telling how much of the tautness was due to the dope and how much to the initial tightening of the fabric. A demonstration was soon arranged, the fabric tacked to the frame at whatever tautness the designer chose, the dope applied and allowed to dry. Usually the resulting drumming was music to the aircraft designer's ear, an order would follow, and it was not long before aeroplanes began to fly with wings and fuselages doped with "Cellon," the name which Mr. Wallace Barr gave to his dope, and which has since become world-famous.

The original Cellon dope had cellulose acetate as a basis, and to it were added the appropriate plasticisers and solvents (the latter was amyl acetate). In those days the firm was very much a one-man-band. Mr. Wallace Barr, the managing director, would attend to all business affairs at his office. Then Mr. Wallace Barr, the sales director, would visit works and aerodromes, give demonstrations, and take orders (sometimes). In the evening

Mr. A. J. A. Wallace Barr (left), managing director of Cellon, Ltd., started his famous firm as a one-man affair.



Mr. W. J. Shilcock, sales director, plots his curves.

(Left) In the laboratory. Mr. H. Lazell, technical director, inspecting test panels with the chief chemist, Mr. W. F. Wilson.

"DOPE" (Continued)

he would report to Mr. Wallace Barr, the works superintendent, who would set about manufacturing the dope. The mixer was a 10-gallon drum, and the "works" were a small shed at Clapham. The solid ingredients were placed in the drum, and one-half of the solvents were added. The mixture was stirred with a broomstick, which was graduated to show the amount of solvent which had to be added to make the correct mixture. The dope was then left until the next morning, when the rest of the solvent was added and the mixture stirred again.

Underneath the Arches

Here it is of interest to record that Mr. Wallace Barr's first contact was with Short Brothers. The fact that they were then working under railway arches at Battersea may have had something to do with this fact, for obviously transport was a consideration. This first dope, by the way, was not for aeroplanes but for balloons, which were the main preoccupation of Shorts in those days. The experiment did not turn out a success, as the dope was not found suitable for balloons, but it was suggested that it might be more suitable for the wings of the aeroplanes which Short Brothers were building at Eastchurch, Isle of Sheppey. This actually turned out to be the case, and it was not very long before other British constructors adopted Cellon, including the British and Colonial (now Bristol) Aeroplane Co., A. V. Roe, S. F. Cody, T. O. M. Sopwith, and Robert Blackburn.

Now business really began to get brisk, and it was only by calling in friends to help him stir the dope on Saturday mornings that Mr. Wallace Barr was able to get the afternoon off for hockey or cricket (in those days he had not acquired the vice of golf). By 1912 many important competitions had been won by aeroplanes doped with Cellon, and in 1913 orders were obtained from the Government. That meant that it was no longer practicable to carry out the work in the shed at Clapham, and arrangements were made for manufacture of Cellon by Thomas Tyrer and Co., Ltd., of Stratford. Towards the end of 1913 Mr. W. J. Shilcock, now sales director, joined Mr. Wallace Barr.

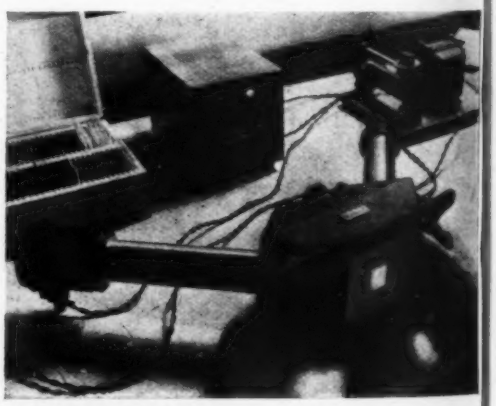
During the war 1914-18 the demand for dope grew tremendously, and in 1916 new works were built at Richmond by Tyrers, exclusively for the manufacture of Cellon. In that year, too, Mr. H. Lazell, now technical director of the firm, was released from the A.I.D. and undertook the supervision of technical manufacture and development. In 1918, just before the armistice, the present company was formed and took over the works. From then onwards the business continued to flourish, and in 1927 the present factory was laid down. It was designed by Mr. Lazell.

During the last war the use of tetrachlorethane was abandoned and the present nitro-cellulose adopted as a basis for aircraft dopes. In addition to these, the Cellon organisation found many uses for its Cerric cellulose lacquers and Cerrux synthetic finishes, and a very large business was built up. That part is, at present, less important than the aircraft branch, but when the war is over there is little doubt that it will resume its former importance. In the meantime, a few words about the care taken in the Cellon laboratories to maintain and improve the quality of dopes and finishes may be of interest.

The tests mainly required are physical rather than chemical, but in the first place all the materials employed are analysed in the chemical laboratory in order to ensure that they are of the required purity. Acidity must be controlled to avoid decomposition in storage and deterioration of the fabric to which the dope is applied. The solvents are checked for various characteristics, including evaporation rate, variations in which can cause difficulties in application and drying.

The finished dope is subjected to further testing, this covering such things as viscosity, tautness, flexibility, durability, smoothness and suitability for application in different atmospheric conditions without blushing and whitening. Microscopic examinations ensure that there are no comparatively large lumps of pigment after grinding.

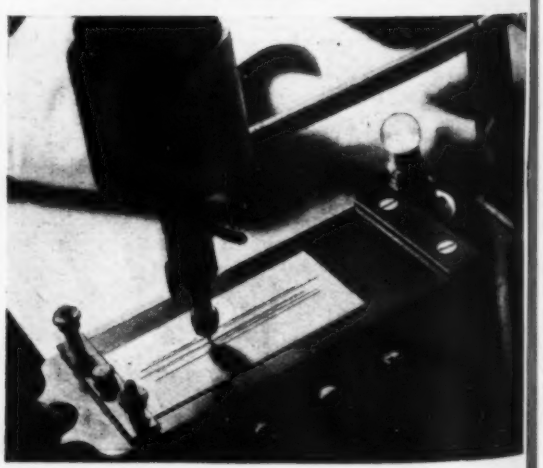
There are various ways of determining viscosity. The most common is to run the dope on test through an orifice of known diameter. The time



(Right) the Cellon gloss meter is used for determining the mattness of surfaces.

(Bottom left) the portable colour matcher, a spinning stack of coloured discs, various proportions of which can be exposed to give the right blended colour.

(Bottom right) hardness of a film tested by measuring its scratch-resistance.



"DOPE" (Continued)

taken to run through at a controlled temperature gives a measure of the viscosity of the liquid.

Reference has been made previously to the finger-tapping test of doped panels in the early days of flying. In modern times a more scientific method is used. The doped fabric on a standard frame of about 1ft. side is tested for tautness by measuring the depression (usually in thousandths of an inch) given to the centre of the panel by the application of a known weight.

Flexibility is an important quality of a dope. Examination can be made of the dope film itself, prepared by evaporation on a bath of mercury or by spinning a flat surface coated with the dope. Usually tests can be applied to the doped fabric. For instance, the standard doped fabric frame can be subjected to a series of heavy blows, of the order of 30 lb./sq. in., followed by examination for cracking. Another method is to bend the fabric backwards and forwards at a high rate until signs of failure appear. Such tests are made in rooms in which the temperature and humidity are controlled. It is also necessary to know how dope behaves under load in the low temperatures encountered by service aircraft flying at great heights or in wintry weather. Such atmospheres are obtained by the use of solid carbon dioxide, temperatures as low as −50 deg. to −60 deg. being reached.

In the early flying days inflammability was something of a bugbear, and it was customary to demonstrate fire-resisting qualities by placing a lighted match on the fabric frame. That was not a fair test, because the smooth surface helped greatly. Nowadays a more severe test is applied. A small fire is started at one end of a doped fabric frame, and the time taken for the flame to travel across, or to extinguish itself, is noted.

The durability which can be expected from a given dope is ascertained by accelerated weathering tests. In these the doped fabric is subjected to extremes of heat and cold, to ultra-violet rays, and to moisture. In a few hours the results are known, but actual tests on an aircraft are a safer guide.

Satisfactory dopes must be suitable for use in atmospheres containing as much as 90 per cent. relative humidity, and at temperatures as low as freezing point, without blushing or chilling.

So much for the dopes themselves. And now a few words about the matt colours applied over them as finishing coats. The protection given is dependent on a very thin coating of such materials. Among the qualities of importance is lack of gloss, as obviously a surface which reflects too much light may reveal the whereabouts of an aircraft. A so-called gloss meter is used for testing this. The paint is applied to a glass plate, and the reflected light is obtained from a standard source of light. This is transformed, via a

A triple-roll paint mill in which adjacent rollers run at different speeds. (Left) running off dope through a glass-fronted metering device.

The despatch bay. Lorries being loaded with Cellon dope and other products.

"DOPE" (Continued)

selenium cell, into electrical energy sufficient to actuate a small mirror held by a moving coil. Light falling on the mirror is thus shown as a beam across a scale, from which the degree of mattness or reflectivity can be read off.

Correct pigmentation during manufacture should yield correct covering capacity, but variations in the degree of dispersion do occur, so that check tests have to be made on the finished batch of colour. A so-called cryptometer is used for this test. A slide of glass with the wet colour underneath it is moved over a reflecting background to form a wedge of paint, to the point when it just obliterates the pattern beneath. The slide is calibrated, and the figure can, therefore, be read off directly.

Hardness Tests

Hardness of finishes can be tested by their scratch resistance. A small panel coated with the finish is drawn under a heavily loaded ball-ended needle. The weight on the needle is increased until the surface is cut through to the metal. This point is shown up by a series of electrical contacts. When the film is cut through, a light shows. Another way is to use the rocking hardness tester, an instrument in which two rings with a pendulum weight are allowed to rock to and fro until the pendulum slows down. The time taken for it to do this is a measure of the hardness.

With finishes for metal, a major requirement is adhesion. This quality can be determined by the bend test apparatus, in which the metal panel is first cooled to freezing point or lower, and then bent around a mandrel of ⅛in. to ¼in. diameter. The finish must withstand this without lifting.

Leading edges of aircraft are often subjected to abrasion in bad-weather flying. An apparatus has been designed to reproduce such conditions. In this, jets of high-pressure air and water impinge on a small panel shaped like a leading edge. In another test special abrasive sand, or sometimes shot blast, is allowed to fall on to the panel under test. In yet another apparatus weights are made to drag or roll over a circular rotatable surface.

Corrosion resistance is of paramount importance in modern aircraft. Research is going on with a view to evolving a method of accelerated testing technique, and it is hoped that it will soon be possible to forecast the protective value of a primer or a complete finishing scheme by means of an electrical method. However, that is a thing of the future, and no details may be given yet.

There are many more interesting things to be seen in the Cellon laboratories, but sufficient has, we hope, been said to indicate the progress which has been made since Mr. Wallace Barr stirred his first dope in the little shed at Clapham.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

CARBURATION v. PETROL INJECTION

Dr. l'Orange's System

CONCERNING this discussion, none of the injection protagonists seem to have referred to the report published by Dr. Prosper l'Orange a short time before the war. It is to be assumed that development staffs have examined his results closely, for they showed a measure of success in applying auto-injection to oil engines, offering at least reason for considering investigation of its application to petrol injection.

At the time of Dr. l'Orange's death, research appeared to be in progress, as a private venture, into the determination of design factors for the capillary passages to ensure uniformity of fuel auto-injection. Presumably the problem of power output control had not been approached.

If anyone has balanced their judgment of the prospects in the system, conclusions arrived at would be of interest.

"ICONOCLASTES."

THE OBSERVER CORPS

A Critic Replies to his Critics

MAY I trespass on your space to answer some of my critics? Form 1204 distinguishes two classes of Observer only: Class A, paid "at an hourly rate of 1s. 3d. an hour," and Class B, "paid at a similar rate." Yet "Keen Observer" states: "There are thousands of observers doing the job voluntarily . . . there is an opening for him if he is one of the voluntary type." Elsewhere he mentions the waiting list. Is this where the opening is to be found?

No one would belittle the duties performed or the hardships endured by Observers, but might not these burdens be lightened if they were more equally spread over the present membership of the corps and those men now on the waiting list?

To discover why this cannot be done we must turn again to Form 1204. "In view of the fact that forty-eight hours a week are guaranteed, the number of men who can be accepted in Class A must of necessity be limited at each Centre and Post." And with regard to Class B members: "The number of hours of duty required of them will partly depend on the number of Class A members at each Centre or Post." In other words, it is the guarantee system which is keeping men out of the Observer Corps and on the waiting list.

There may, as "Keen Observer" says, be some who join for the pay and others because there is a chance of exemption from other service. But can he tell us why the latter, presumably of military age, should be guaranteed a wage of £3 a week? (In case he imagines I belong to this category, I must inform him—with regret—that my age is forty-eight.)

Mr. J. H. Maxfield imagines those who anticipate compulsory national service casting envious eyes towards the Observer Corps. But why *envious* if the conditions of service are so onerous?

Some of your correspondents take me to task for not discovering the merits of the Observer Corps earlier. In common with many others, I have become aware of its existence only during the past six months. And when I first applied for membership I supposed its part-time members were, like the Home Guard, unpaid.

OBSERVING ENQUIRER.

Net Remuneration at 3d. per Hour!

WHEN your correspondent hinted that observers were too highly paid I thought he was joking. Perhaps he is. Anyhow, the 30,000 of us who plot the hostile aircraft out of doors earn in a year between us about £1,500,000, and the war is costing £14 millions a day. So that the observers are not seriously to blame for the astronomical figures of war costs. I do four duties a week and earn £1. We try to arrive in very good time for the change-over and often have oddments to do at the end of our four hours; so that I find, including journeys to and fro, that each duty takes five hours—in all, twenty hours per week.

Driving to and fro, at the usual rates allowed to employees of our local council, comes to 1s. per duty—that is, 4s. per week. We pay 1s. a week into the canteen; extra food costs 1s. 6d. per week and income tax, for most of us, comes to 8s. 6d. This adds up to 15s. a week, so that for my twenty hours I net 5s., which is 3d. per hour! Not very princely pay!

The Home Guard in our village have already had denim uniforms and, later, serge ones served out with army boots, leather putties, long serge capes, forage caps, regimental badges and armlets. We have only cheap berets and armlets and have to share official raincoats or provide our own. Many of us were in the Observer Corps years before Munich in September, 1938. In September, 1940, we were told that uniforms would be issued by Christmas. Yes, but which Christmas?

NORMAN G. BRETT-JAMES.

Service Aviation

Royal Air Force and Fleet Air Arm News and Announcements

F.A.A. Decorations

HIS Majesty The King has approved making available the D.F.C., D.F.M., A.F.C. and A.F.M. to officers and men of the Fleet Air Arm. It is intended that these distinctions should be for flying personnel of the F.A.A. who have either been individually lent to the R.A.F. or whose naval units were operating under the command of an Air Officer Commanding in Chief. Two of the first awards to be made under the new arrangement are those of the D.F.C. to Lt. Cdr. W. E. Waters, and Sub-Lt. E. David. Air Force personnel serving with the Fleet Air Arm are already eligible for certain naval decorations—the Distinguished Service Cross, the Conspicuous Gallantry Medal, and the Distinguished Service Medal.

Awards

THE King has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations.

The number after each name indicates the squadron with which the recipient is serving:—

DISTINGUISHED FLYING CROSS.

Wing Commander Wilfred P. J. THOMSON, No. 38.
Squadron Leader Robert J. GOSNELL, No. 38.
Lieutenant Commander W. E. WATERS, R.N., No. 812.
Flight Lieutenant Cecil G. S. ROBINSON, No. 14.
Flight Lieutenant Gordon Henry STEEGE, R.A.A.F., No. 3.
Flying Officer Francis Charles BARRETT, R.A.F.V.R., No. 70.
Flying Officer Martin BRYAN-SMITH, R.A.F.V.R., No. 38.
Flying Officer Lindsay B. BUCHANAN, No. 211.
Flying Officer Kenneth Crispin V. D. DUNDAS, No. 211.
Sub Lieutenant Evan DAVID, R.N.
Pilot Officer Leonard Henry DAY, No. 38.
Pilot Officer Ronald W. PEARSON, No. 211.

Wing Cdr. G. A. BARTLETT, No. 21.—In March, 1941, this officer was the pilot of an aircraft which took part in a sustained attack on an enemy aerodrome. In spite of intense and accurate anti-aircraft fire he pressed home his attack from a low level, dropping bombs at intervals, while his gunner machine-gunned the aerodrome.

During one run over the target Wing Cdr. Bartlett was wounded and his aircraft severely damaged, but he continued his attack for the allotted time, dropping bombs which caused considerable damage to the aerodrome and to a dispersal area. Wing Cdr. Bartlett succeeded in flying his damaged aircraft back to base and landing safely. He has shown exceptional leadership, courage and determination.

Wing Cdr. S. C. WIDDOWS, No. 29.—This officer has commanded the squadron since July, 1940, and, under difficult circumstances, has maintained a high morale among the personnel. Wing Cdr. Widdows has carried out a large number of difficult patrols in bad weather, and has shown extreme keenness to engage the enemy. He has flown a considerable number of hours of operational flying at night, and succeeded in destroying a Junkers 88 one night in March, 1941.

Act. Sqn. Ldr. G. A. W. SAUNDERS, No. 65.—Sqn. Ldr. Saunders has served in this squadron since its formation, and was appointed to command in October, 1940. He has spared no effort to improve the efficiency of his squadron, and its present high standard of operational efficiency is entirely due to his leadership. Sqn. Ldr. Saunders has personally destroyed at least three enemy aircraft.

DISTINGUISHED FLYING MEDAL.

Flight Sergeant Leslie Arthur J. PATEY, No. 14.
Flight Sergeant Arthur Frederick PLANT, No. 38.
Sergeant Henry MORTON, No. 228.
Sergeant Edward William ROSAM, R.A.F.V.R.

Sgt. C. G. HUGHES, R.A.F.V.R., No. 61.—In March, 1941, this airman was the pilot of an aircraft which carried out a successful operation over Cologne. On the return journey, while at about 8,000 feet, he observed an enemy aerodrome fully illuminated and in operation. Although he had expended all his bombs, Sergeant Hughes determined to attack a number of aircraft in the vicinity of the flare path.

He dived to 2,000 feet, at which height he saw two Junkers 87 circling the aerodrome. He immediately attacked each in turn, and tracer bullets were seen to enter the fuselage of the second aircraft. Pulling out of his dive at 300 feet, and whilst climbing, he attacked a Messerschmitt 110, which, after a burst from his front gun, was observed to crash.

Sergeant Hughes displayed great initiative in these attacks, which were carried out persistently and fearlessly. He has completed eighteen operational flights, displaying a high standard throughout.

Sgt. C. F. RAWNSLEY, A.A.F., No. 604.—Sgt. Rawnsley has shown great keenness both as an air gunner and radio operator, and has materially assisted his pilot to destroy two enemy aircraft.

Sgt. H. H. ROGERS, R.A.F.V.R., No. 115.—One night in March, 1941, this airman was detailed to attack an important target at Hamburg and to carry out a reconnaissance. The flight, which was successful, entailed several runs over the target despite heavy anti-aircraft fire and searchlight activity.

On a previous occasion, when unable to locate his target, he succeeded in bombing an important alternative target and an enemy aerodrome in Holland. On nearing his base he was attacked by enemy aircraft, and, although his aircraft was extensively damaged and his rear gunner wounded, he succeeded in landing his aircraft without further injury to his crew. He is an exceptional captain of aircraft who shows the greatest reliability and coolness on all occasions.

TAILS UP: Three Vickers Wellington long-range bombers flying south-east. The Wellington has acquitted itself well in every theatre of war and will doubtless do so again in the Balkans.

Roll of Honour

Casualty Communique No 64.

THE Air Ministry regrets to announce the following casualties on various dates. The next-of-kin have been informed.

KILLED IN ACTION (WHILE FLYING ON OPERATIONS AGAINST THE ENEMY).—Sgt. G. F. Asbrey, 755393; Sgt. B. Bingley, 742701; F/O. J. B. Boys-Stones, 33434; Sgt. S. V. Bunn, 748368; Sgt. J. Conway, 755389; Sgt. E. Fenwick, 939539; Sgt. J. N. Glendinning, 740032; Sgt. H. Gordon, 747861; Sgt. S. Hamer, 758049; Sgt. H. F. Jennings, 509139; P/O. P. J. Kearsey 85239; Sgt. D. Laing, 627416; Sgt. T. D. Leitch, 741611; Sgt. J. Levy, 548053; Sgt. T. W. Little, 522543; Sgt. J. C. Lockwood, 754820; Sgt. C. W. MacDougal, 811002; P/O. F. B. Pollitt, 87566; P/O. G. S. Smith, 60314; F/O. F. F. Taylor, D.F.C., 70821; Sgt. T. J. Thurling, 754631; Sgt. A. W. Tubbs, 564445; P/O. R. A. Webb, 83296; P/O. J. Whitsed, 83220; Sgt. K. Wright, 975751.

PREVIOUSLY REPORTED KILLED IN ACTION, NOW REPORTED MISSING.—Sgt. J. S. Gilders, 741587.

PREVIOUSLY REPORTED MISSING BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—A/C.1 J. W. Allison, 543233; Sgt. G. K. Biggins, 550227; P/O. A. J. G. Bisson, 41774; Sgt. P. Bower, 524415; Sgt. J. B. M. Brown, 741269; Sgt. J. G. Cowlishaw, 590842; P/O. J. H. Deas, 33539; Sgt. G. E. Duck, 551700; Act. Sgt. S. G. Fox, 747815; P/O. T. A. Grundy, 42306; Sgt. J. G. Juggins, 562162; L.A/C. T. McLoughlin, 551464; F/O. W. R. P. K. Mason, 70450; Sgt. J. Morton, 642718; Act. Flt. Lt. J. D. W. Murray, 39559; L.A/C. T. Murray, 540176; Sgt. M. M. Shanahan, 741623; L.A/C. P. D. Snowden, 526768; Sgt. C. D. Stevens, 581538; Sgt. A. L. Stewart, 624161; Sqn. Ldr. C. W. Williams, 26219; L.A/C. D. J. R. Wilson, 527234; Sgt. N. F. Wilson, 747962.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. A. S. Ainslie, D.F.C., 37310; Sgt. J. W. T. Alderslade, 903455; P/O. C. J. D. Andreae, 70018; Sgt. E. T. Apperson, 580923; P/O. H. L. Atkin-Berry, 41560; P/O. G. M. Bailey, 42330; Sgt. A. Baird, 639105; Act. Sgt. F. E. G. Bailey, 755360; P/O. H. C. M. Bamber, 42375; Act. Flt. Lt. I. H. Bartlett, 25095; F/O. T. G. Bassett, 40781; P/O. N. J. Brisbane, 41897; Sgt. B. W. Burt, 751689; Sgt. R. C. Caldwell, 580434; P/O. J. S. Cameron, 33458; Act. Sgt. D. F. S. Campbell, 743031; Sgt. J. W. Candlish, 533257; Sgt. C. M. Clayton, 754914; Sgt. R. D. Cook, 580997; Sqn. Ldr. D. Cooke, 26009; L.A/C. J. K. Copeland, 531915; P/O. J. H. H. Copeman, 41257; Flt. Sgt. P. G. Cory, 564165; A/C.1 D. T. Crockett, 570634; Sgt. R. Crombie, 903506; P/O. J. Cruttenden, 40895; P/O. H. L. N. Davis, 72988; Sgt. D. W. Dawson, 580767; Sgt. M. L. Dent, 524057; P/O. W. G. Dickie, 80541; L.A/C. J. J. Dixon, 532692; Sgt. G. T. Drew, 580431; Sgt. F. R. Edwards, 741487; F/O. C. F. Elder, 70787; A/C.2 A. W. Elliot, 626895; Flt. Sgt. J. W. Elliott, 564608; P/O. A. C. Ennis, 70896; Sgt. W. J. K. Evans, 580951; P/O. H. P. G. Fisher, 78443; P/O. G. N. Gaylard, 41398; Sgt. E. V. Gibson, 905664; P/O. J. D. W. Gillam, 40690; F/O. J. Gillan, 37675; A/C.1 A. A. Gillmore, 552644; Sgt. G. Gledhill, 742857; Sqn. Ldr. A. R. Glen-cross, 26230; F/O. A. M. Gofton, 39312; L.A/C. D. Gow, 532923; Sgt. J. W. Greig, 548517; Flt. Lt. N. M. Hall, A.F.C., 33166; Sgt. F. D. Hardy, 624501; P/O. J. B. Harrison, 76577; Sgt. J. W. Hartfield, 740678; Sgt. P. S. Hayes, 740268; Sgt. F. A. P. Head, 902546; Sgt. R. Hewitt, 521236; Sgt. J. Holdsworth, 749458; P/O. L. M. Hossack, 33568; Sgt. C. A. Irwin, 564214; P/O. M. T. E. Jenkins, 40832; Sgt. S. W. Johnson, 937626; Sgt. A. D. Kelso, 581155; Sgt. F. G. Kingham, 535306; Sgt. C. B. Kircher, 515103; Sgt. R. W. Lawrence, 531399; Sgt. E. D. Leamy, 569067; Sgt. D. J. Lees, 565583; P/O. I. F. Lothian, 42717; Sgt. W. McCrorie, 615278; P/O. R. M. McDonough, 42137; Sgt. G. P. McLoughlin, 580205; Sgt. C. F. Mackay, 549190; L.A/C. J. Mahoney, 548565; Sgt. E. Marrows, 522870; Sgt. S. E. Masham, 740246; Sgt. R. Mercer, 639880; Sgt. W. Millner, 580106; L.A/C. E. R. Morris, 536055; Sgt. J. S. Morton, 741362; F/O. P. N. Murton-Neale, 90401; Sgt. G. E. Negus, 749517; Act. F/O. B. Nokes-Cooper, 77362; F/O. A. E. Oakley, 36152; Sgt. W. C. H. Paish, 511862; Sgt. R. C. Parkhouse, 580833; Sgt. J. Parkinson, 748411; P/O. A. G. Pascoe, 40746; Act. Flt. Lt. M. C. Pearson, 33274; P/O. M. A. Phillips, 81002; Sgt. F. Phillipson, 563677; F/O. G. V. Proudman, 39947; Sgt. F. Pursglove, 516705; P/O. J. B. Ramsay, 41204; L.A/C. H. Revill, 747795; P/O. F. B. Ridley, 41208; P/O. A. G. Rigg, 41067; Sgt. C. Rose, 651369; Sgt. L. W. Routledge, 580737; Flt. Lt. F. W. Rushmer, 90192; L.A/C. J. A. Russell, 618567; P/O. L. A. Sears, 42895; P/O. J. L. Smithers, 90540; F/O. S. G. Soderholm, 40194; Sgt. J. Sulter, 617486; P/O. A. Swainston, 90610; Act. Flt. Lt. I. C. Swann, 39950; P/O. F. Sydenham, 77793; A/C.1 G. E. Tanner, 625471; A/C.1 J. S. Thomson, 613420; Flt. Lt. L. T. W. Thornley, 90398; P/O. S. G. Thornton, 41497; Sgt. B. L. Trayhurn, 562891; Flt. Lt. D. F. Turner, 32254; L.A/C. G. L. Walters, 533619; Sgt. H. Warman, 580275; Sgt. L. Whittle, 533685; Flt. Lt. R. D. G. Wight, D.F.C., 34187; P/O. T. S. Wildblood, 33478; Flt. Lt. A. E. Williamson, 37370; P/O. R. R. Wilson, 41513; Sgt. J. C. Winston, 935571; Act. Flt. Lt. L. C. Withall, 39361; Sgt. S. M. Wood, 751655; L.A/C. D. V. Woods, 551566; P/O. E. A. Wray, 42174; Sgt. J. Young, 523927; Sgt. S. F. Youngson, 652041.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. B. Henson, 742563.

WOUNDED OR INJURED IN ACTION.—P/O. P. D. Bowen, 42481; Sgt. A. Francis, 903808; Act. Sqn. Ldr. P. A. Gilchrist, D.F.C., 37348; P/O. H. H. Kitchener, D.F.M., 87029; Flt. Lt. M. R. MacArthur, 70416; P/O. R. H. McDonald, 42316; Sgt. H. G. Matthews, 647815; Sgt. D. McK. Muir, 524756; Sgt. N. H. Welch, 758097.

SERVICE AVIATION (Continued)

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. A. R. Severn, 939987.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. F. H. Abbott, 745965; Sgt. R. M. Cutting, 590946; Sgt. T. A. Edwards, 970695; W/O. H. J. Goodchild, D.F.M., 517435; Sgt. R. R. J. Nute, 523120; Sgt. V. H. Skillen, 745460; Sgt. A. C. White, 970692.

MISSING.—F/O. P. T. Anderson, 84833; Sgt. V. L. Bagley, 754080; Wing Cdr. J. E. M. Bainbridge, 05139; Sgt. D. C. Beddow, 748747; Sgt. C. H. Bell, 754849; Sgt. R. C. Brockway, 758014; Sgt. C. Mac. L. Calder, 628103; Sgt. J. Cameron, 969956; Sgt. G. H. Carter, 935349; Sgt. P. G. V. Chanler, 745661; Sgt. J. F. Cooper, 754709; Sgt. S. J. Cooper, 749383; Sgt. T. S. Courtman, 640819; P/O. E. F. Cragg, 78670; Flt. Lt. R. N. Cullen, 39967; P/O. W. I. Dalgliesh, 87044; Sgt. G. C. Daniel, 618264, Cpl. W. C. Davis, 570228; Sgt. R. L. Dingle, 754495; Sgt. A. G. Elder, 754780; Sgt. G. L. Elliott, 937772; Sgt. A. B. Ferguson, 745113; P/O. F. P. Ferris, 86406; P/O. R. J. Fyfe, 44549; Sgt. R. L. Grainger, 758212; Sgt. H. W. Green, 939533; Act. Sqn. Ldr. J. M. Griffith-Jones, D.F.C., 37734; Sgt. E. S. C. Halsall, 936497; Sgt. R. Hinton, 562132; Sgt. J. N. Holdsworth, 749461; Sgt. E. Hughes, 751491; Sgt. T. S. H. Hunter, 755013; Sgt. J. S. Legge, 567417; Sgt. T. O. Lewis, 970474; Sgt. G. J. Little, 654626; Sgt. J. Mc. I. McDonald, 621572; L.A/C. A. E. McQuitty, 911664; Sgt. R. H. S. Maton, 581235; Sgt. W. A. Newton, 747993; Sgt. H. K. Pass, 979685; Sgt. G. R. Pike, 902481; Sgt. R. Player, 745848; F/O. D. K. Plumb, 41734; Sgt. J. Pringle, 746741; Cpl. W. J. Richards, 572635; Sgt. N. Rowell, 755292; Sgt. A. R. Taylor, 982555; Sgt. W. E. Tilley, 516417; P/O. A. L. T. Todd, 79558; Sgt. J. La B. Tomkinson, 701366; F/O. R. P. Turner, 74694; Sgt. A. Warcup, 748149; Sgt. R. D. Watson, 759157; Sgt. A. W. White, 903902; F/O. J. N. Whitney, 41087; Sgt. R. E. F. Wunderlich, 745394.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE (WHILE ENGAGED ON NON-OPERATIONAL FLYING DUTIES OR ON THE GROUND THROUGH ENEMY ACTION).—A/C.2 R. Shepherd, 1050924; A/C.2 J. Staunch, 1055973; Sgt. G. Tock, 741785.

KILLED ON ACTIVE SERVICE.—F/O. G. Allard, D.F.C., D.F.M., 44551; F/O. E. T. Banks, 40978; A/C.2 J. W. Beasley, 1115130; P/O. W. Bird, 79749; Sgt. W. F. H. Buthee, 747930; L.A/C. J. S. Coogan, 1252908; P/O. B. A. R. Deall, 43545; Sgt. J. W. Dewar, 755432; Sgt. P. G. Durham, 514156; Sgt. T. Dykes, 741239; Sgt. I. C. Elkins, 742893; Sgt. D. B. Flanders, 976088; Sgt. A. V. Gaskell, 970129; F/O. P. L. Gordon-Deane, 33436; F/O. A. J. Grisenthwaite, 40908; Sgt. W. D. Gubbins, 908507; Sgt. B. J. D. Hall, 741173; Flt. Lt. R. J. Hill, D.F.C., 40300; F/O. C. C. Hitch, 41181; P/O. W. H. Hodgson, D.F.C., 36269; P/O. H. S. Hopkins, 89335; Sgt. R. G. W. Jenkins, 959288; Sgt. A. S. Jones, 530722; L.A/C. J. W. E. Newnham, 1258210; Sgt. Ldr. C. R. J. Pink, 33093; A/C.2 M. Radstone, 1375114; P/O. R. B. Redfern, 83453; Act. F/O. J. A. Strong, 84162; A/C.2 S. W. Summerell, 997777; Sgt. F. R. Walker-Smith, 741213; Sgt. G. E. Worledge, 1376105.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—A/C.2 R. E. Barker, 939176; P/O. A. E. Q. Bourgeois, 42100; Sgt. G. H. McCrory, 580666; A/C.2 E. Pickford, 966179.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—A/C.2 J. G. Forbes, 1109587; A/C.2 T. Jones, 1021753; A/C.2 W. C. McDonald, 1070559; A/C.2 M. F. McHugh, 1108072.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—A/C.2 R. Peck, 1006143.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.2 A. Bullock, 1115064; A/C.1 J. M. Bell, 853506; A/C.1 C. H. Birkhead, 1058767; Sgt. L. C. Crossley, 951761; Sgt. J. Edwards, 748481; A/C.2 J. Harris, 644489; L.A/C. L. J. Hayes, 641354; A/C.1 G. Hughes, 853883; Sgt. G. P. Jones, 611027; A/C.2 H. Lewis, 1284658; A/C.1 G. E. Parkinson, 954579; W/O. W. L. Powell, 511377; P/O. J. G. Rogers, 86388; A/C.1 C. F. Smith, 991735; A/C.1 R. Taylor, 986185; A/C.1 A. Worthington, 539965.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. D. H. Gittins, 85319.

DIED ON ACTIVE SERVICE.—L.A/C. C. L. Burgess, 749154; Sgt. J. A. Cook, 742035; A/C.2 C. H. Courtney, 1213934; A/C.2 C. A. Crowle, 1179815; A/C.1 W. H. Fleetwood, 869565; A/C.2 C. Frodsham, 1069669; A/C.2 D. R. Hilton, 1038910; A/C.1 G. F. Laver, 913861; A/C.2 D. H. Locker, 1352042; A/C.1 S. McKell, 1063917; A/C.1 R. R. McNeight, 853883; A/C.2 W. J. Morgan, 1264925; A/C.1 E. H. Nason, 944798; A/C.1 E. Roberts, 992944; A/C.1 H. A. Roberts, 620703; A/C.2 J. McA. Robson, 992840; A/C.2 Z. E. Rowan, 774664; L.A/C. P. D. Rowland, 552173; A/C.2 F. G. Sanders, 1208174; A/C.1 W. W. Short, 625576; A/C.1 T. N. Smith, 1153229; A/C.2 A. J. Smitheringale, 1028352; A/C.2 W. G. Southgate, 756073; A/C.2 T. Spears, 1117773; A/C.2 E. Strauss, 775122; A/C.2 A. Taylor, 1104214; L.A/C. R. L. Watson, 873026; L.A/C. R. J. Whitaker, 538632; W/O. F. A. Williams, 358503.

PREVIOUSLY REPORTED MISSING, NOW SAFE.—Sgt. J. H. Wyatt, 754237.

W.A.A.F.

KILLED ON ACTIVE SERVICE.—A/CW.1 B. Wright, 897565.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/CW.1 S. Peterman, 895043; A/CW.2 M. B. Thomas, 897561; A/CW.2 G. M. Wickham, 425649.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Cpl. J. H. Langridge, 37156.

MISSING.—Sgt. S. Glazer, N.Z., 40621.

London Gazette

Royal Air Force

Air Ministry, April 4, 1941.

General Duties Branch.

The follg. are granted temp. comms. as P/Os. on being employed with R.A.F.:—(March 8) D. D. Bonnett, Lt., R. Fus.; A. M. C. Wigan, Lt., C. Gds.; A. H. Bruce, 2nd Lt., Gordons; R. H. Buchanan, 2nd Lt., A.S.H.; G. R. Brown, 2nd Lt., R.A.; J. H. Clough, 2nd Lt., W. Yorks R.; A. D. E. Devenish, 2nd Lt., R.A.; L. W. Goodman, 2nd Lt., R.A.; J. B. Green, 2nd Lt., R.A.; J. M. Garlick, 2nd Lt., R. North. Fus.; R. Huggins, 2nd Lt., R.A.; R. V. Hudson, 2nd Lt., R.A.; R. P. Hay, 2nd Lt., Cameronians; J. C. D. Langley, 2nd Lt., R.E.; D. M. Maxton, 2nd Lt., R.A.S.C.; G. A. Mockeridge, 2nd Lt., R.A.; J. R. Pennington, 2nd Lt., N. Stafford R.; D. R. Parker, 2nd Lt., R. Sussex R.; A. C. Pickett, 2nd Lt., Dorset R.; W. A. Skelton, 2nd Lt., R.E.; A. W. Wright, 2nd Lt., Cheshire R.; R. Waters, 2nd Lt., R.A.; D. M. Wright, 2nd Lt., Black Watch. (March 9) A. Allan, 2nd Lt., R.A.; R. H. Powell, 2nd Lt., Mon. R.; A. R. Weldon, 2nd Lt., R.A. (March 10) T. W. Palmer, 2nd Lt., E. Lancs R.

The follg. are granted comms. for durn. of hostilities as P/Os. on probn.:—Flt. Sgts.: (March 1, Sen. July 30, 1940) F. W. J. Paddon; (March 10) V. C. H. Colbourne. Sgts.: (Jan. 15, Sen. Aug. 8, 1940) R. I. Perry; (March 3) D. Gallanders, D.F.M.; (March 6) K. E. Naish; (March 16) A. L. Collett.

The follg. F/Os. are promoted to war substve. rank of Flt. Lt.:—(Jan. 1) W. E. Williamson (Suppy. List), J. G. MacDonald (Suppy. List).

The follg. F/O. is granted war substve. rank of Flt. Lt.:—(April 9, 1940) G. C. O. Key, D.F.C.

The follg. P/Os. are granted war substve. rank of F/O.:—(Jan. 2) R. W. Jeary; (Feb. 13) L. Crooks, D.F.C.; (Feb. 19) J. M. Edwards; (Feb. 25) A. P. Peskett.

The follg. P/Os. are promoted to war substve. rank of F/O.:—(Sept. 3, 1940) P. S. Anderson, P. V. Lockett, W. Stapleton; (Feb. 1) P. D. Bowen, F. A. Bowler, D. Evans, I. P. C. Goudge, R. A. Hubber Richards, D. A. A. Ross, M. Rowell, D.F.C., H. J. C. Tudge; (Feb. 18) G. W. O'N. Fisher; (Feb. 20) S. A. F. Bowen; (Feb. 28) G. C. T. Carthew, J. J. Le Roux, R. D. Rutter; (March 24) H. R. Allen.

The follg. Air Comdres. are granted act. rank of Air Vice-Marshal:—(March 9) R. D. Oxland, O.B.E.; (March 24) A. J. Capel, D.S.O., D.F.C.

Sqn. Ldr. J. D. Baker-Carr is transfd. to Technical Branch (April 24, 1940).

Flt. Lt. R. A. G. Morgan resigns his comm. (March 17).

GIVE HIM THE WORKS: A fitter trainee learning the intricacies of the power operated rear gun turret of a Bristol Blenheim.

F/O. C. A. J. Macnamara resigns his short service comm. (March 28)

Erratum.

In notifn. of March 21, concerning G. P. R. Anslo. *For* Anslo *read* Anslow.

Technical Branch.

The follg. are granted comms. for durn. of hostilities as P/Os. on probn.:—Warrant Officer: (Jan. 30) S. F. King. Flt. Sgt.: (Feb. 24) B. G. Greenbank.

Sqn. Ldr. J. D. Baker-Carr is promoted to rank of Wing Cdr. (temp.) (Dec. 1, 1940).

The follg. F/Os. are granted war substve. rank of Flt. Lt.:—(Jan. 19) H. Waite; (Feb. 11) J. E. Manton; (Feb. 15) A. B. Collins.

The follg. P/O. is granted war substve. rank of F/O.:—(Jan. 26) D. L. Thomas.

Administrative and Special Duties Branch.

The follg. are granted comms. for durn. of hostilities:—As F/O. on prob.: Warrant Officer: (March 8) C. E. Upton. As P/Os. on probn.: Warrant Officers: (March 10) C. H. Leese; (March 14) S. J. Eales, M.B.E., P. J. Tungay. As Act. P/Os. on probn.: Flt. Sgts.; (March 8) R. H. Young; (March 14) J. R. Oswald.

The follg. P/Os. on probn. are promoted to war substve. rank of F/O. on probn.:—(Dec. 1, 1940) L. J. Nolder; (March 1) R. W. Salmon.

The follg. P/Os. are granted war substve. rank of F/O.:—(Feb. 4) S. A. Bennett; (Feb. 11) R. S. Sweetlove; (Feb. 12) P. Duxfield; (Feb. 20) F. T. Solis; (Feb. 27) P. P. Pryse, C. T. W. Morgan, R. Mallett; (Feb. 28) F. W. T. Pryer.

The follg. P/Os. on probn. are transfd. to Technical Branch:—(Sept. 9, 1940) V. C. Ewens, R. B. Greenhow.

Equipment Branch.

W/O R. E. J. Blanche is granted a comm. for durn. of hostilities as P/O. on probn. (Feb. 28).

Wing Cdr. W. F. Bryant (Ret.) relinquishes at own request the rank of Wing Cdr. whilst reemployed with R.A.F. and assumes rank of Sqn. Ldr. (March 14).

Act. P/O. on probn. P. G. Tilbrook is graded as P/O. on probn. (Feb. 22).

F/O. S. W. Waller is transfd. to Administrative and Special Duties Branch (March 12).

Accountant Branch.

Act. P/O. on probn. J. W. H. Dailly is graded as P/O. on probn. (Dec. 14, 1940).

Flt. Lt. T. F. Frost is granted war substve. rank of F/O. (Feb. 28).

Medical Branch.

Air Marshal Sir A. V. J. Richardson, K.B.E., C.B., M.B., B.Ch., D.P.H., K.H.S., is placed on retired list at his own request (Mar. 1).

Princess Mary's Royal Air Force Nursing Service

The follg. Sisters resign their appts.:—(Mar. 18) Miss D. M. Dixon, Miss J. M. West.

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

F/O. H. C. Biard is transfd. to Administrative and Special Duties Branch (Mar. 17).

F/O. D. M. B. Fitzgerald-Lombard relinquishes his comm. in Class CC on appt. to a comm. in R.A.F.V.R. (Sept. 1, 1939).

F/O. T. C. M. Wigg resigns his comm. (Feb. 15).

Administrative and Special Duties Branch.

F/O. R. A. Whitehead is transfd. to General Duties Branch (Feb. 27).

Royal Air Force Volunteer Reserve

General Duties Branch.

The follg. are granted comms. for durn. of hostilities as P/Os. on probn.:—(Mar. 10) J. S. Feather, D. W. H. Heath, A. L. Walker; (Mar. 14) A. F. Burns. Sgts.: (Feb. 7) A. D. Walker, K. E. Whalley; (Feb. 26) A. E. Jackson, D.F.M.; (Mar. 7) L. S. Davies, N. S. Mingard; (Mar. 12) H. J. Davidson. Ldg. Aircraftmen: (Jan. 25) R. A. Kewley; (Feb. 9) T. L. McA. Woods, H. A. C. Batten, R. Broadbent, J. H. Dunk, P. A. W. Gwynne, J. H. Leuty, A. F. Forsdike, J. E. Evans; (Feb. 16) J. C. I. Hooper; (Feb. 18) J. Flynn; (Feb. 23) E. H. Jacob, W. W. Burgon, D. A. S. Colvin, J. R. Duncan, S. A. Fannon, M. J. Gardener, T. Livingstone, H. B. Wilson; (Feb. 24) R. V. Trueman, C. J. Harper, E. S. Gilbert; (Feb. 28) A. St. C. Harrison, L. Cocker, A. L. Williams; (Mar. 5) A. B. Hutchison, L. McArdle, E. R. Pearson, O. A. Reid, A. Roberts, P. E. Soutter; (Mar. 6) A. H. Comfort, M. W. Kinmouth, W. G. Watson; (Mar. 7) A. E. Johnson, H. Liley, R. F. B. Temperley, J. J. Allen, J. E. Bartrum, C. E. Crichton, S. R. Pemberton; (Mar. 8) F. E. Fuller; (Mar. 9) J. B. Ranson, E. C. J. Wood, R. A. Wright, J. O. Young, R. H. Bear, R. Ellis-Brown, T. R. Fyles, M. G. Gummer, C. Landreth, B. B. Mill, S. T. Whitaker, C. C. G. George, T. B. Grenon, C. Hargreaves, G. L. A. McKenny, E. D. Main, B. F. W. Matthews, F. L. Rippingale, J. N. Andrews, W. N. Crebbin, A. E. Fanshawe, J. R. B. Firth, P. Goode, F. E. A. Gough, G. I. Hutchinson, A. C. Powner, D. J. Raby, M. W. Rivers, L. S. B. Scott, D. P. White, G. F. Lowes; (Mar. 10) P. R. Matthews, E. M. Watts, G. H. S. Pullen, J. D. Forrest, K. F. Glock, T. Nisbet.

P/O. on probn. J. H. Duart is confirmed in his

SERVICE AVIATION (Continued)

appt. Feb. 3 and promoted to war substve. rank of F/O. (Mar. 16).

The follg. P/Os. on probn. are confirmed in their appts. on Dec. 30, 1940, and promoted to war substve. rank of F/O.:—(Feb. 4 1940) J. H. F. Hansen, G. F. Hogg.

The follg. P/Os. on probn. are confirmed in their appts. and promoted to war substve. rank of F/O.:—(Jan. 14) F. E. Frayn; (Feb. 1) J. W. Burman, B. O. Buskell, D.F.C., D. E. Mileham, C. E. V. Thompson, D.F.C.; (Feb. 10) H. Hollingdrake, E. F. Walter.

P/O. C. S. J. Roy is promoted to war substve. rank of F/O. (Mar. 9).

F/O. H. H. Ricketts is transfd. to Technical Branch (Nov. 24, 1940).

P/O. on probn. W. V. Craig is transfd. to Administrative and Special Duties Branch (Mar. 22).

P/O. on probn. C. B. Wilson resigns his comma. (Mar. 23).

Technical Branch.

The follg. are granted commns. for durn. of hostilities as Act. P/Os. on probn.:—(Mar. 7) J. A. H. Johnston, B. H. Jones, The Hon. J. W. Leslie, Sgt.: (Mar. 14) H. E. Andrews.

The follg. P/Os. on probn. are confirmed in their appts. and promoted to war substve. rank of F/O.:—(Feb. 3) J. P. Lynas; (Feb. 13) J. Addison; (Feb. 16) V. C. D. Gray.

The follg. P/Os. are granted war substve. rank of F/O.:—(Feb. 1, 1940) A. M. De Hanteville Bell; (Feb. 14) H. F. Maddox, C. I. Rutherford; (Feb. 15) B. A. Hoskins, F. J. Heath, A. H. Ratcliffe.

Balloon Branch.

The follg. are granted commns. for durn. of hostilities as P/Os. on probn.:—Sgts.: (Feb. 17) F. B. Arnison; (Feb. 18. Sen. Nov. 14, 1940) R. H. Thomas. Cpls.: (Jan. 24) H. Mayo; (Mar. 10) D. M. Enstick, A. N. Smith, K. E. Gormly; (Mar. 14) G. E. Day. L.A/C.: (Jan. 24) A. Solomons. A/C.1: (Jan. 24) J. Raymond.

The follg. P/Os. are granted war substve. rank of F/O.:—(Feb. 1) J. H. Tylee; (Feb. 4) V. C. J. Heeley.

Administrative and Special Duties Branch.

Lieut. D. M. B. Fitzgerald Lombard (R.N.R. Ret.) is granted a comma. as Flt. Lt. (Sept. 1, 1939).

The follg. are granted commns. for durn. of hostilities as P/Os. on probn.:—(Dec. 13, 1940) R. Lawson; (Feb. 17) F. A. R. Rand; (Feb. 24) C. G. Leigh Hunt; (Mar. 2) H. G. Gilliland; (Mar. 7) C. A. Arnett, R. Banks, T. C. Barnard, H. S. Beatty, M.C., R. S. B. Beckett, V. N. Bhardwai, R. Bickley, W. G. Buchanan, J. W. Cochrane, W. W. C. Collett-Mason, H. St. E. Dracott, J. H. Durrant-Woodhouse, L. A. Fawke, A. G. Fenn, C. D. G. Garland, H. A. S. Greenhill, G. W. Hardcastle, E. T. Hawley, A. S. Hersee, R. B. Hodgkinson, J. H. John, W. Korner, G. A. Le Mesurier, R. B. Mackinnon, R. M. M. Milne, M. H. Moss, G. J. O'Connor, R. H. Oppenheimer, A. B. Paton, F. L. Preston, N. H. Pringle, C. L. Richardson, J. S. Robinson, H. M. Sanderson, D. K. Sibbald, G. A. Stillingfleet, M. A. Torpy, J. V. Turton, A. J. Williams: (Mar. 8) C. Condy, T. R. W. Cropper, K. F. H. L. De Berniere Smart, H. G. Greenwood, H. C. Newman, R. H. E. Peters; (Mar. 12) I. K. Macalaster; (Mar 13) R. Levy, H. Hughes; (Mar. 17) A. R. Briggs, F. Burgess, E. J. Chambers, G. Duncan, K. McK. Dyer, A. T. L. Forster, H. Foulds, H. Gordon, H. Steels, K. McK. Topping. Act. W/O.: (Mar. 7) E. C. Pittam, D.C.M. Sgt.: (Jan. 8. Sen. Dec. 23, 1940) D. Wilkie. As Act. P/Os on probn.:—(Dec 31, 1940) E. R. Nichols. Sgt.: (Feb. 24) C. J. Bradley. Cpls. (Mar. 14) I. D. Keith, J. W. Gray, R. S. Gray, L. A. J. Mathers, E. V. Sallery, J. M. Dawson, H. R. W. Jeanes, S. P. Beaumont, R. J. Unstead. Ldg. Aircraftmen: (Mar. 14) H. G. Morison, M. K. Walker, W. K. Sankey. Aircraftmen 1st Class. (Mar. 7) M. Ken:; (Mar. 14) H. P. Ardley, P. B. Hepburn, I. Nicholls, C. Dixon, K. Maher, W. E. Lees, G. W. Shepherd. Aircraftmen 2nd Class: (Jan. 31) W. Thomson: (Mar. 7) E. E. Wollen, J. Cooksley; (Mar. 8) D. Garrick; (Mar. 11) T. G. Rankin; (Mar. 14, Sen. Nov 28 1940) W G Carter; (Mar. 14) J. W. Bennett, G. W. Blake, P. G. Dwyer, L. S. O'Donnell, A. W. Zimmermann, G. B. G. Benson.

The follg. P/Os. on probn. are confirmed in their appts. and promoted to war substve. rank of F/O.:—(Sept. 26, 1940) A. J. Swain; (Oct. 31, 1940) J. A. Daniell. (Nov. 30, 1940) S. G. Rivers; (Jan. 30) A. B. Peters; (Feb. 4) R. W. G. Scott; (Feb. 8) A. G. Powell; (Feb. 12) E. Pralle, A.F.C.; (Mar. 11) L. R. Langmead; (Mar. 15) N. A. Rowe; (Mar. 16) A. R. Weyer; (Mar. 18) W. J. Guppy; (Mar. 20) E. N. Hewitt; (Mar. 21) A. Nolan.

Act. P/O. on probn. P. M. W. H. Clear is graded as P/O. on probn. (Jan. 31).

P/O. R. C. Michaelson is granted war substve. rank of Flt. Lt. (Feb. 7, 1940).

The follg. F/Os. are granted war substve. rank of F/O.:—(April 2, 1940) T. G. W. Gardiner-Robinson; (Sept. 4, 1940) D. S. Chetwood; (Sept. 29, 1940) A. H. G. Craske; (Nov. 24, 1940) C. Middleton; (Dec. 1, 1940) J. S. C. Neel; (Dec. 10, 1940) F. E. Hodgson; (Dec. 18, 1940) N. B. Sherwell; (Jan. 1) C. R. Tunks, C. S. Watkinson; (Jan. 8) J. H. Weaver; (Jan. 10) P. B. Shewan; (Jan. 12) H. J. S. Lund; (Jan. 19) M. McGougan; (Jan. 22) D. C. L. Potter; (Jan. 26) J. F. Burnet, H. R. Bourne; (Jan. 30) R. E. H. Gould; (Jan. 31) R. M. D. Anderson; (Feb. 1) J. McG. Asher, N. P. Anson, A. H. Watters, D.F.C., J. T. D. Bird, C. Mackay, J. W. Higgins; (Feb. 2) J. Sharp, T. G. N. Pearce; (Feb. 3) F. Farmer, H. E. Clover; (Feb. 4) J. Fairhurst, W. S. S. Harper, H. R. Whateley, E. Betts; (Feb. 5) H. H. B. Newbury, J. G. H. de Roeper, H. S. Cardew, M.C.; (Feb. 6) J. Appleton, M.C.; (Feb. 7) C. R. Lawrence; (Feb 8) F. C. Whittan, P. H. Magrath, E. C. Bredin; (Feb. 9) R. T. Mark, M.C., E. F. S. Halliday, F. W. Ford, C. A. Ponsford; (Feb. 10) S. H. Cooper, H. G. Maturin, O.B.E. (substd. for notifn. of Mar. 7); (Feb. 11) G. D. Venables, C. H. H. Holland, J. Tee, D. M. J. M. Spencer; (Feb. 12) J. H. Jennings, A.F.C.; (Feb. 13) W. Thorp, P. G. A. Harvey; (Feb. 15) A. H. Fabian, R. C. C. Green, A. E. Balfour, E. Thursfield; (Feb. 16) H. Hillier, C. F. Clarke, A. G. Hardwick, G. L. Reckitt, M.C.; (Feb. 17) J. W. Chance; (Feb. 18) F. H. Popham, T. Oliphant; (Feb. 19) F. L. Champanhac, H. Roland-Taylor; (Feb. 20) R. Leycester, M.C., T. Terrell, R. N. Benjamin, M.C., H. G. Dawson; (Feb. 21) A. W. C. Butler; (Feb. 22) H. L. Chadwick, C. R. Whately, D. B. Cumming, D.F.C., R. Maudling; (Feb. 25) G. V. L. Hooman; (Feb. 24) M. G. Kidston, R. M. Barrington-Rein Ganum; (Feb 25) F. Conway, F. Lapton, A. B. Thompson, S. W. Thompson, H. F. King, Sir R. T. Leighton, Bart, T.D., D.L., A. C. M. Jackaman; (Feb. 26) A. O. Dickinson, L. G. Scarman; (Feb. 27) E. Hosey, A. H. Curtis; (Feb. 28) I. M. Parsons, B. K. O. Mathews, J. H. Bolt.

The follg. P/Os. on probn. are transfd. to General Duties Branch in the rank of F/O:—(June 14, 1940) G. A. A. Grant, W. L. Irving, G. MacGregor; (June 15, 1940) H. Baty, L. Mercer; (June 21, 1940) T. D. Dryadale, W. H. MacIntyre.

The follg. P/Os. on probn. are transfd. to General Duties Branch:—(Nov 1, 1940) A. A. Booth, A. H. E. Frost; (Nov. 18, 1940) F. C. Lander, A.F.C.; (Nov. 27, 1940) G. V. Vaughan; (Mar. 24) I. C. Rushton.

The follg. are transfd. to Technical Branch:—Sqn. Ldr.: (April 24, 1940) M. H. Butler, D.F.C. Flt. Lts.: (April 24, 1940) F. Susans, M.B.E.; (May 28, 1940) E. H. Rundle. F/Os.: (April 24, 1940) H. G. Hudson; (Feb. 10) P. A. Towsey. P/Os. on probn.: (April 24, 1940) J. V. Newson; (June 25. 1940) A. W. Bowyer; (Aug. 14, 1940) C. G. Moore (since promoted), C. N. Kington (since promoted), E. M. Lewis; (Aug. 20, 1940) P. N. H. Gush; (Sept. 2, 1940) W. A. Proctor; (Sept. 9, 1940) T. A. Rose; (Sept. 17, 1940) T. H. Jackson, R. P. Gibb; (Oct. 2, 1940) A. K. Maley; (Oct. 4, 1940) C. R. Jeffries; (Oct. 15, 1940) W. Barclay; (Oct. 28, 1940) N. H. Holm, J. A. Macqueen; (Nov. 15, 1940) D. V. Briggs; (Nov. 24, 1940) O. M. Williams, C. E. Wellings, G. S. Shaw, B. R. Hutchinson, H. B. E. Waters, H. L. Wright, L. E. Wilcox; (Nov. 25, 1940) H. N. P. Riley, G. S. Tydeman, F. J. Sandeford; (Dec. 6, 1940) J. R. Currie; (Dec. 7, 1940) G. D. Monteath; (Dec. 21, 1940) G. O. Manning, R. W. Leaning, V. B. Husband, A. B. Howe, B. R. Spencer; (Jan. 12) W. E. Sands; (Jan. 26) D. R. R. H. Surgeoner; (Feb. 2) J. B. Evans; (Feb. 10) J. Hurst, F. W. Hayter; (Feb. 17) E. R. L. Lewis; (Feb. 26) R. G. Burnett.

P/O. on probn. G. P. Taylor is transfd. to Balloon Branch (Mar. 27, 1940).

The follg. P/Os. on probn. relinquish their commns. on account of ill-health:—(Dec. 31, 1940) R. Crofton; (Mar. 31) V. De La Motte Hurst, W. Wilkinson.

P/O. G. F. W. C. Hughes-Chamberlain resigns his comma. (Mar. 23).

The commns. of the follg. P/Os. on probn. are terminated on cessation of duty:—(Mar. 19) A. C. Handford; (Mar. 22) G. R. Treacy.

Errata.

The notifn. of Oct. 27, 1939, concerning Maj. E. A. Palmer, M.C., should have appeared under heading "Equipment Branch" and not "Administrative and Special Duties Branch."

In notifn. of Mar. 14, concerning F/O. G. Rogerson. *For* Dec. 2, 1941, *read* Dec. 2, 1940.

Training Branch.

The follg. are granted commns. for durn. of hostilities as Act. P/Os. on probn.:—(Feb. 1) N. Armstrong, H. Blake, H. Chandler, J. Chesters, E. Copper, A. Crowther, J. Davy, A. S. Dodd, W. T. Edwards, T. A. Hales, F. W. D. Howeis, J. M. Kilburn, H. F. Longbottom, D.F.C., D. R. Mackinlay, T. R. Oliver, E. A. Robbins, H. A. Slater, D.S.O., S. B. Stokes, P. H. Watson, L. A. Woodruff; (Mar. 4) F. Austin, W. H. M. Branston, T. Morgan, J. F. Robinson, A. P. Sedgwick, C. W. M. Taggart; (Mar. 7) R. Petty, C. W. Pinton; (Mar. 8) G. A. J. Barnes, C. Bowles, T. H. Ellement, E. A. Flint, H. F. Marks, J. Parkin, E. C. Thompson, J. H. Trickey, E. L. Winter; (Mar. 12) W. H. Davies; (Mar. 14) E. J. N. Bramall, H. F. Elbourne, W. R. Hecker, D. W. Walters; (Mar. 18) E. C. G. Handscomb, J. W. Holmes, J. A. Strugnell, W. B. Yapp; (Mar. 19) A. W. Thomas, D. C. Whimster.

Equipment Branch.

The follg. are granted commns. for durn. of hostilities as Act. P/O. on probn.:—(Feb. 17) L. A. Moore; (Mar. 14) H. G. Alderton, E. A. Bennett, H. P. Bennett, W. H. Coddington, F. P. Coombes, F. R. P. Digman, R. Godson, J. E. H. Grainger, H. Henry, G. H. Hignett, A. L. Kershaw, C. S. Lain, A. O. Lewis, G. R. Linley, W. S. M. Long, R. W. Osborn, G. B. Rushton, A. W. Saqui, P. T. Sayer, N. M. Sewell, F. C. Simpson, R. F. Taylor, L. M. Thompson, T. G. Thorne, A. M. Vigoureux de Kermorvan, J. Whitehouse, E. W. Wolfe, K. C. Wright-Watson.

The follg. P/Os. on probn. are confirmed in their appts., Nov. 9, 1940, and promoted to war substve. rank of F/O.:—(Jan. 20) J. P. Hill, R. T. W. Ketton-Cremer, E. D. Kyte, F. A. Shearing; (Jan. 22) R. T. Chapman.

The follg. P/Os. on probation are confirmed in their appts., Nov. 21, 1940, and promoted to war substve. rank of F/O.:—(Jan. 20) J. C. Allan, E. D. Gosschalk, R. Grace, H. R. Johns, F. W. Penn, R. C. Thorby, D. H. Upcott.

The follg. Act. P/Os on probn. are graded as P/Os. on probn.:—(Nov. 25, 1940) J. H. Brown, C. A. Case; (Feb. 22) J. R. MacGregor, H. Gray.

The follg. P/Os. are granted war substve. rank of F/O.:—(Jan. 30, 1940) G. F. Woolf; (Dec. 6, 1940) C. Heard-White; (Feb. 1) H. B. Sissmore, B. H. Miller; (Feb. 12) R. A. Heppenstall, H. Peat, E. A. Pratt; (Feb. 15) G. L. A. Wilding; (Feb. 20) J. H. Whewell; (Feb. 28) F. G. Bullimore.

Act. P/O. on probn. L. V. Bailhache is transfd. to Administrative and Special Duties Branch (Feb. 21).

Act. P/O. on probn. H. B. Briggs relinquishes his commn. on account of ill-health (March 29).

The comma. of P/O. on probn. A. Hardy is terminated on cessation of duty (March 5).

Accountant Branch.

The follg. P/Os on probn are confirmed in their appts., Nov. 28, 1940, and promoted to war substve. rank of F/O:—(Jan. 22) G. Hawley, C. E. Leather.

The follg. Act. P/Os. on probn. are graded as P/Os. on probn.:—(Dec. 14, 1940) J. J. Appleby, P. H. C. Burgess, M. Garvin, G. de F. Gibson, T. R. G. Haworth, H. Holman, W. F. H. James, A. Martin, C. G. Moira, T. Ridley, C. G. G. Smart, C. L. Lumley-Ellis, H. W. Shiner, L. Swann; (Jan. 4) H. T. Armstrong, B. D. Helmore; (Feb. 15) A. Gray; (Feb. 23) K. Hartlett; (March 7) A. H. Boughton, T. R. Burton.

The follg. P/Os. are granted war substve. rank of F/O.:—(Jan. 3) A. W. Shand; (Feb. 9) L. G. Crosby; (Feb. 14) R. H. Wood.

Medical Branch.

The follg. are granted commns. for durn. of hostilities (Feb. 28):—As Flt. Lt.: W. Leslie, M.B., B.S., F.R.C.S. As F/Os.: W. C. D. Bewick, M.B., B.S.; C. P. Williams, M.R.C.S., L.R.C.P.; J. K. Swanston, L.R.C.P. & S., L.R.F.P.S.; W. P. Soutter, M.B., Ch.B.; J. J. O'Dwyer, M.B., B.Ch., L.M.; R. L. Markham, M.B., B.S.; J. H. C. Williams, M.B., B.Chir.; H. Brewster, M.B., B.Ch.; J. M. Crawford, M.B., Ch.B. D.P.H.; W. H. G. Elliott, M.B., Ch.B.; J. G. Fee, M.B., B.Ch.; J. Lillie, M.B., B.Ch; I. M. Macgregor, M.R.C.S., L.R.C.P.; J. James, M.R.C.S., L.R.C.P.; A. E. Ward, M.D., L.M.C.C., M.R.C.P. & S.; W. G. Zorab, L.M.S.S.A.

The follg. F/Os. are promoted to war substve. rank of Flt. Lt.:—(Dec. 1, 1940) C. Barton, M.B., B.Ch.; (Jan. 23) G. E. B. Scott, M.R.C.S., L.R.C.P.; (Feb. 13) A. J. Beddie, M.B., Ch.B.; (Feb. 27) P. S. Meyrick, M.B., B.S., M.R.C.S., L.R.C.P. H. W. Sanderson, M.R.C.S., L.R.C.P.; (March 26) N. A. F. Young, M.R.C.S., L.R.C.P.

Dental Branch.

The follg. are granted commns. for durn. of hostilities as F/Os.—(March 11) J. E. Benfield, L.D.S., H. W. Callow, L.D.S., F. Kershaw, L.D.S., K. S. Bacon, L.D.S., L. Falconer, L.D.S., G. D. Caldwell, L.D.S., G. J. Moore, L.D.S., D. J. McKechnie, L.D.S.

The follg. F/Os. are promoted to war substve. rank of Flt. Lt.:—(Nov. 14, 1940) G. C. Baird, L.D.S.; (Nov. 21, 1940) D. Wolffe, L.D.S.

Auxiliary Air Force

General Duties Branch.

P/O. J. S. Dickson is promoted to war substve. rank of F/O. (Feb. 25).

P/O. C. D. Newman is transfd. to Equipment Branch, March 27, 1940, and further transfd. in rank of F/O. to Technical Branch, Oct. 28, 1940. (Notifns. of Jan. 7 and Feb. 14 are cancelled.)

P/O. W. P. Barrell resigns his comma (March 26).

Balloon Branch.

The follg. P/Os. are granted war substve. rank of F/O.:—(Dec. 7, 1939) P. F. Heppell (substd for notifn. of Oct. 8, 1940); (Dec. 8, 1939) S. Wilson (substd. for notifn. of Nov. 12, 1940); (Dec. 19, 1939) W. R. S. Arkless (substd. for notifn. of Oct. 8, 1940).

Administrative and Special Duties Branch.

In notifn. of Feb. 4, 1941, concerning P/O. C. H. Cadney, *for* Cadney *read* Gadney.

Auxiliary Air Force Reserve of Officers

General Duties Branch.

F/O. W. H. Wetton is granted war substve. rank of Flt. Lt. (Feb. 11).

Women's Auxiliary Air Force

The follg. are apptd. Assist. S/Os.:—(March 17) A/CW.2 D. Colles, A/CW.2 M. E. Hemelryk, A/CW.2 K. O. Ougham, A/CW.2 U. M. Powys-Lybbe. A/CW.2 E. A. O. Whiteman; (March 22) A/CW 1 R. E. C. Darby, Cpl. N. Dawson, A/CW.2 W. Nation. A/CW.1 S. E. Ruddin, A/CW.2 B. E. Sims, A/CW.2 H. F. Worthington; (March 24) A/CW.2 F. E. M. Colmore, A/CW.2 M. Concannon, A/CW.2 R. G. Doyle, Sgt. H. C. Fisher, Sgt. N. Goodfellow, Cpl. K. Harland, Sgt. N. I. Henty, A/CW.2 J. M. Hide, Sgt. I. W. Hooper, Cpl. S. M. McDougall, A/CW.2 H. K. Pocock, A/CW.2 R. E. Pollock, A/CW.2 E. Waterman.

The follg. Asst. S/Os. relinquish their appts.:—(Feb. 15) E. M. Hill; (March 18) J. Forbes; (March 22) M. M. Thomson; (March 24) The Hon. L. A. V. Falkiner.

Asst. S/O. K. Thompson relinquishes her appt. on account of ill-health (April 1).

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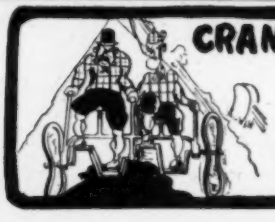

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